The Foundry

for November

Renard Champions The Buyer

BUSINESS moves in cycles. Sellers markets are followed by buyers markets. When the condition of either is aggravated by war or depression to the extent that American industry expands beyond reason or is forced to curtail as in recent lean years, some of those who sit in the driver's seat may act unfairly.

In a letter published on page 46, G. A. Renard, executive secretary-treasurer of the National Association of Purchasing Agents rises to the defense of his clients with time-worn questioning arguments which befog rather than clarify the real problem.

Tragic economic conditions confront American industry when depression, unemployment and lack of purchasing power place ruthless buyers at too great an advantage.

In sellers markets, business booms. Men get high wages, full time employment, good living and prosperity abound. Then, some sellers being ruthless or greedy do take unfair advantage. For such we offer no defense. In buyers markets equal human frailty or even viciousness tends to further suffering of men, exhaustion of resources, defeat and disaster for all. Sound business morals and sound economics both demand in buyers and sellers a fairness, moderation and understanding which rebuild rather than push down all American industry.

In any industry all firms are not equally efficient, but all are both sellers and buyers. In depressions all but the most favored are in distress. Kicking the less favored while they are down makes no more customers for the nation's goods.

This nation needs to re-tool. It must be ready for war or peace. Today it is not ready. If money and skill were available, it would take the industries of America 15 years to recover, rebuild, re-tool and bring about that equalized high state of efficiency and economy in production which Mr. Renard's thinking demands overnight.

Laws, unions, consolidations, agreements, distress selling or unfair buying which prevent adjustment of all costs to changing economic conditions, grind the whole nation, its industries, agriculture, railways, investors and laborers farther into universal poverty.

To be successful sellers in such a period more of us must be fair buyers. While we speak for the foundry industry, the truth fits all other American industries.

Profits and profits only can rebuild American industry, including foundries. Without profits there will never be re-employment, large individual purchasing power, or even a continuation of government purchasing power.

Buyers, therefore must give sellers, themselves in both cases, a chance to make profits, to re-employ, to re-tool, to recover America's industrial position. Large numbers of buyers already act on that principle or we would not now see the dawn of recovery.

Post-Divorce Honeymoon

EARLY in October, Maj. George L. Berry, coordinator for industrial co-operation, sent letters to several thousand manufacturers, associations and those identified with disbanded code organizations asking if those addressed would attend a Washington conference. The conferees were to be representatives of industry, labor and consumers. The subject announced was "consideration of the best means for accelerating industrial recovery."

In all seriousness the best means, Major, would be not to confer.

American business won a divorce from NRA by court decision. Industry seeks to live no more with that fickle, domineering, extravagant consort.

Recovery should not be jeopardized by this sounding off in a new attempt to fasten NRA or any similar contrivance on business.

Editor

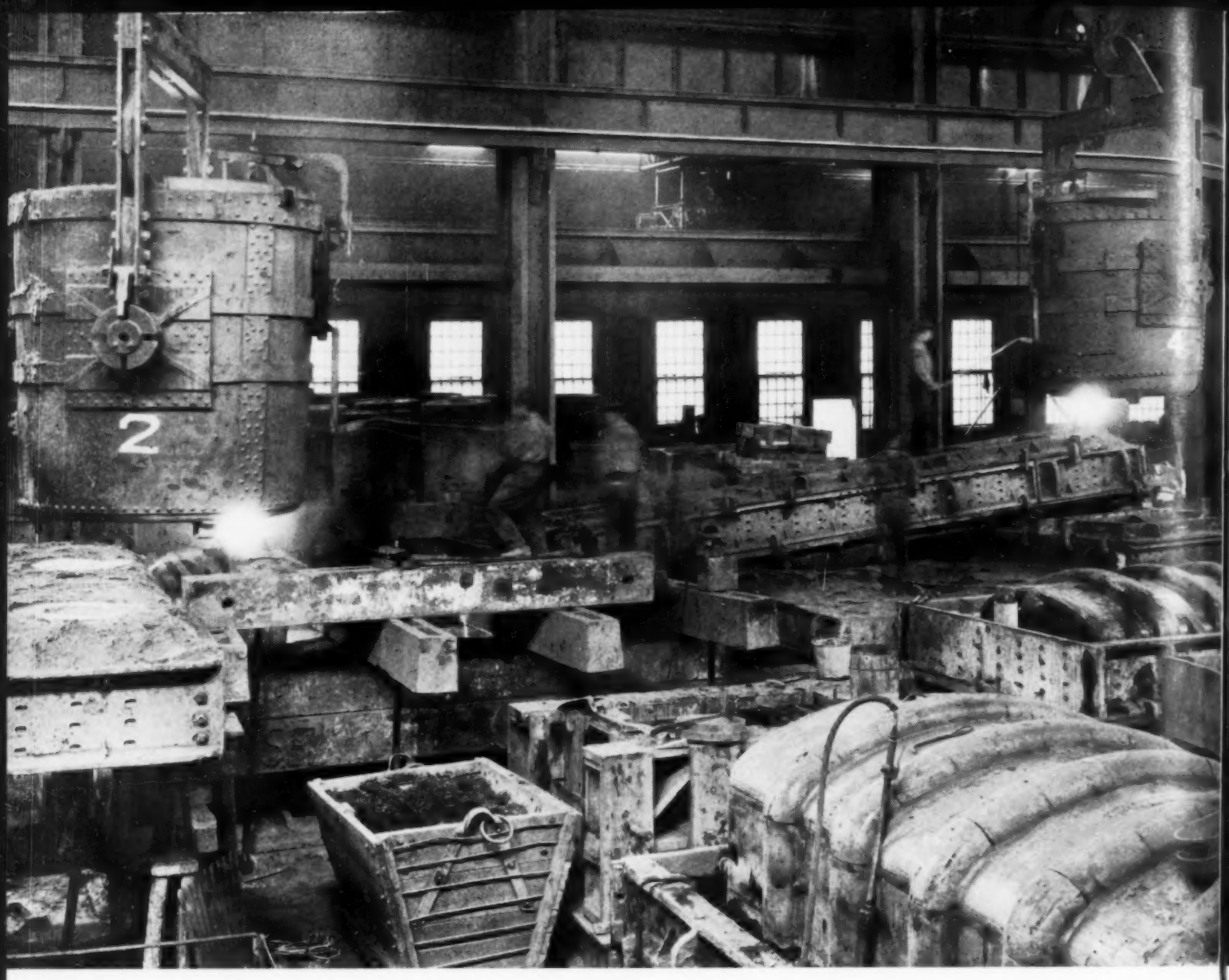


Fig. 1—A long pouring basin built up on an incline conducts the metal from a second ladle at the right to supplement metal from ladle at the left

PENNSYLVANIA STEEL FOUNDRY

CARRYING capacities of the three railroads that serve the plant constitute the only limiting factor to the size and weight of the castings and forgings made by the Mesta Machine Co., West Homestead, Pa., a suburb on the Monongahela river a few miles above Pittsburgh. Iron and steel castings up to 165 tons have been produced in the foundry and finished in the machine shops. The company specializes in the design and manufacture of rolls and rolling mill machinery, gas and steam engines, forging and bending presses, large machine tools, cut and machine molded gears.

Recent installations include two 79-inch continuous hot sheet strip mills, the largest in the world for rolling light gage strip, at the main plants of the Inland Steel Co., Chicago and the Youngstown Sheet & Tube Co., Youngstown, O. Also duplicate hot and cold mill installations of the same type for the Bethlehem Steel Co., Bethlehem, Pa., and the Great Lakes Steel Corp., Detroit.

Beginning in 1893 as a comparatively modest establishment, the Leechburg Foundry & Machine Co., Leechburg, Pa., absorbed the Robinson-Rea Manufacturing Co., Pittsburgh in 1898. The company then was incorporated as the Mesta Machine Co. and the present plant and

Fig. 2—Ingots designed to be forged into shafts are poured slowly through a small opening in the bottom of a reservoir mounted on top of the ingot mold

PRODUCES HEAVY CASTINGS

By PAT DWYER

general offices were erected on a 26-acre site. It is a straight line, unit plant with practically all departments under one roof and supervised by one organization. Two main buildings each 1000 feet in length house the machine shop and foundry. They are connected by an office building containing the employment and welfare department, time office, apprentice school, police department and hospital. The main office of the company housing the executive, sales, auditing, purchasing, cost departments and superintendents offices is located at one end and adjacent to the machine shop. A two story pattern shop occupies space at one end of the foundry building, while the metallurgical department, chemical, physical and research laboratories are housed in separate buildings.

Increasing difficulty in maintaining a staff of highly skilled mechanics in the various departments, induced the company many years ago to establish a training school where carefully selected young men receive class room instruction designed to supplement the actual and practical manual training they receive as apprentices in the shop. Many of the most highly skilled mechanics, experts in their respective lines are graduates of this apprentice training school. Several hold responsible positions.

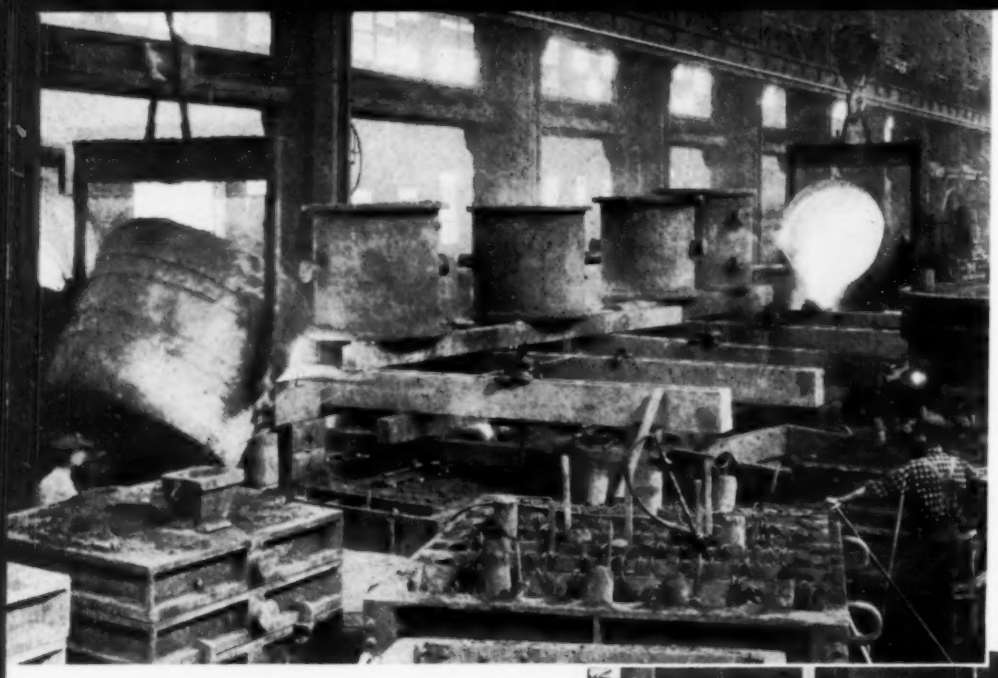


Fig. 3—Copes on large pit molds are held down with weights and binder bars

In accordance with developments in recent years the working day of 24 hours is divided into three 8-hour shifts. The apprentices are assigned to the first and second shifts, one commencing at 7 a.m., and the other at 3.30 p.m. The class room work in connection with the apprentice training course is arranged so that on the days appointed, the boys enter the class room first before they go into the shop. At that time they are fresh and clean and therefore more in harmony with the surroundings. This method also prevents interruptions of the working schedule in the shop.

While the basic principles of founding are the same for all metals, the practical applications of these principles find a particularly wide scope in the production of large, heavy castings. Problems of the repetition foundry where immense quantities of small duplicate castings are made day after day, differ widely from those in a foundry where duplicate castings are the exception rather

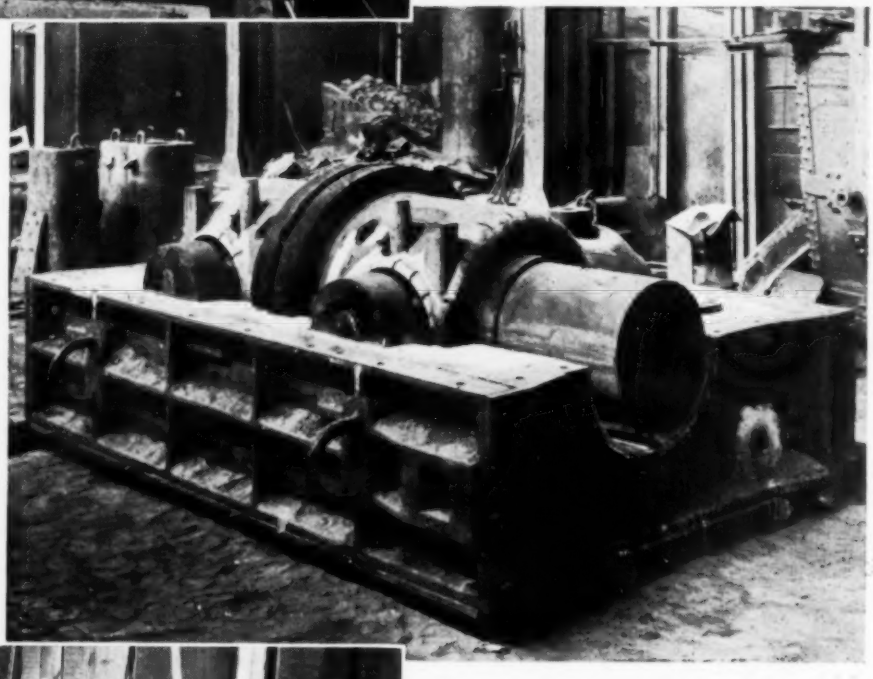


Fig. 4 (Left)—Nearly all large molds are made in pits in the floor. Fig. 5 (Above)—Gas engine cylinder is molded horizontally and then turned on end for pouring

than the rule and where manual skill and dexterity must take the place of certain forms of mechanical equipment. Manifestly a thorough grasp of the essentials, backed by wide general knowledge only to be gained through actual experience, is required in the construction of molds that involve from a few hours to 200 hours work. Here every step in the process must coordinate perfectly with the others.

Practically all of the former hard back breaking labor incident to the production of large castings now is performed by

the modernly harnessed industrial giants electricity, steam, water, air and gas. The main bay of the foundry is spanned by a series of electric traveling cranes with lifting capacities ranging from 50 to 150 tons. Natural gas is employed for drying the molds in the floor and for melting the steel in the furnaces. Pneumatic tools ram the sand and chip the castings. Grab buckets suspended from the cranes mix the sand, carry it from place to place and fill the flask or the pits in the floor

Two rows of columns support

Fig. 7—Size and weight of castings are limited only by carrying capacity of the railroads

Fig. 6 (Above)—Typical gates and riser on large steel casting. Fig. 8 (Right)—View in one section of core room where skeleton boxes are used extensively

the exceptionally high roof of the building and divide the foundry into three bays devoted respectively—for the main part—into a melting department, a molding and cleaning department, and a core making department. Taking each bay more in detail, a space approximately 100 feet long at one end of the first bay is devoted to the production of small iron and nonferrous castings. The iron for this bay and for certain miscellaneous castings made in the main bay is melted in a 60-inch cupola. Nonferrous metals are melted in an open flame oil furnace. A space approximately the same dimensions at the opposite end of the bay is utilized as a blacksmith shop.

Remainder of the bay is occupied entirely by the melting furnaces and accessories. Iron in a wide range of compositions to meet exacting requirements, is melted in a battery of eight hand fired air furnaces, one of 10-tons, four 16-ton and three of 30-ton capacity. A considerable volume of the metal is poured into chill and sand rolls and the remainder into other

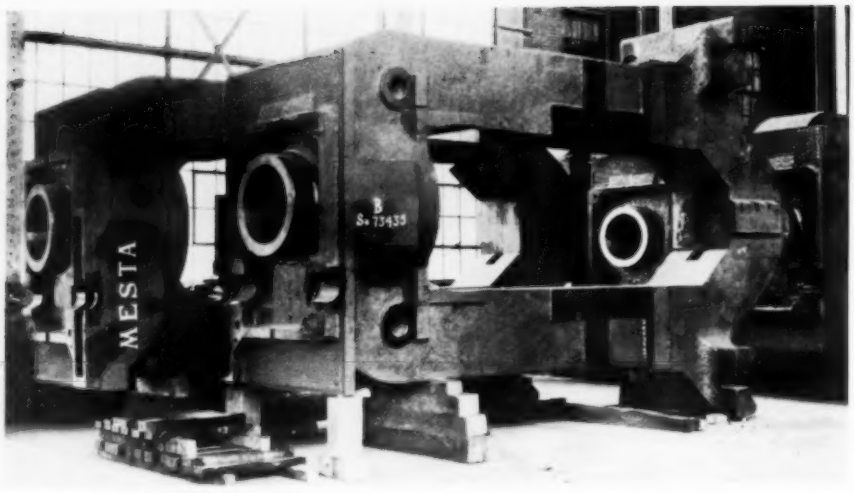


Fig. 9—Pair of cast steel roll housings machined and ready for shipment

castings. The outer end of each furnace projects through the side wall of the building and is provided with a platform on which the materials for the charge are placed before they are placed in the furnace. Pig iron and scrap according to their several classifications are piled in the yard adjoining the building and are handled by three cranes. A gasoline locomotive shunts incoming and outgoing cars. Large pieces of scrap are broken to furnace size in a pit under a drop ball manipulated by one of the cranes. After the furnace is charged the open end of the furnace is closed by a brick lined door and the joint is sealed with clay.

Bituminous coal for firing the furnaces arrives at the plant in drop bottom railroad cars and is discharged through gratings in the track into a basement which extends under the greater part of the side bay of the foundry. A sufficient amount for firing each furnace is lifted as required and piled close to the firing door at one side and close to the inner end. Operation of this type of furnace has been covered in considerable detail in recent articles dealing with roll making practice. Long, curved spouts conduct the molten metal from the furnaces to ladles suspended from cranes in the main bay of the foundry. Since the tapping hole of the furnace necessarily is close to the floor level, the ladle is lowered into a pit for the reception of the metal. Each pit serves two furnaces and in that manner—if necessary or desirable—heats from two furnaces may be tapped into a single ladle.

Four acid lined open hearth furnaces are located in the same bay, one of 30 tons and three of 40 tons capacity. Whereas the air furnaces for melting the iron occupy positions at right angles to the side wall of the building, the open hearth furnaces lie parallel. The tapping spouts project over pits for the reception of ladles in the main bay. The back or working side is served by a charging machine which lifts loaded pans from small railroad buggies and discharges the contents in the furnaces.

Raw materials are purchased to close specifications. The pig iron carries a low phosphorous and sulphur content and the greater part of the scrap is railroad material. All alloy additions, silicon, manganese, chromium, molybdenum, nickel, etc., are made directly in the furnace. Nickel is added in the form of small slabs. Exceptionally favorable melting conditions are secured through the use of natural gas as a fuel. A simple type of mushroom reversing valve in the basement controls the air intake.

Commencing at one end of the center bay approximately one third of the floor space is taken up with molds for iron castings. Considerably more than one third of the total floor space in this bay is devoted to the production of steel castings. The remainder of the bay is taken up by ingot casting pits, annealing furnaces and the casting cleaning department. Iron and steel rolls are assembled and cast in a number of deep concrete lined pits located between the iron and steel molding divisions. Roll molding and casting technique is similar (*Please turn to page* 60)

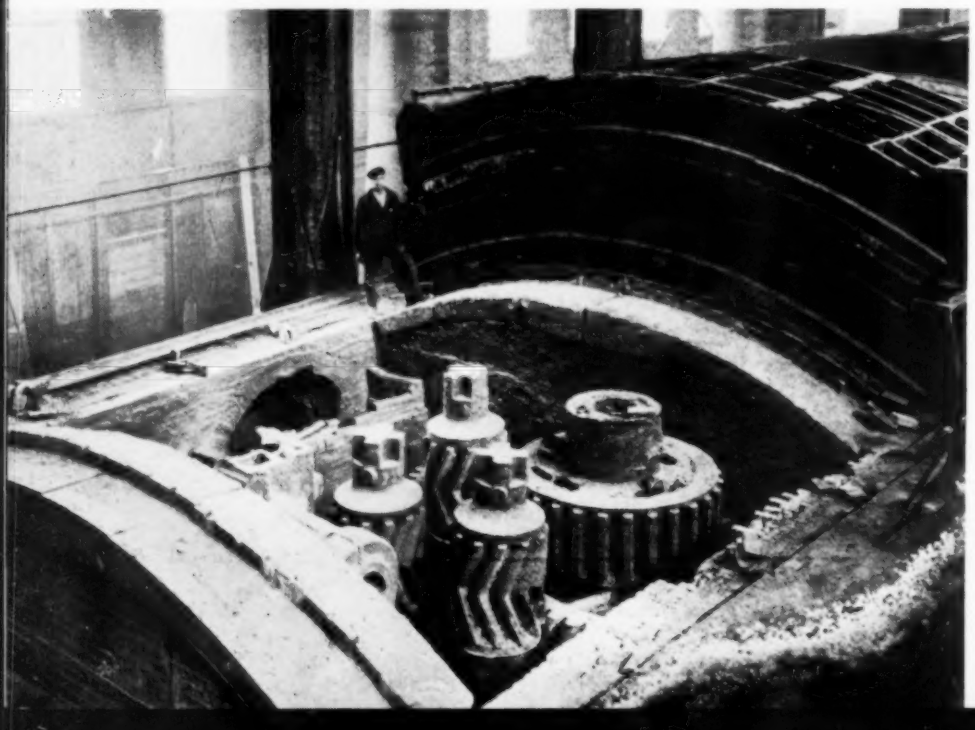


Fig. 10 (Left)—Steel castings are annealed in long furnaces divided into chambers and covered with a number of removable bungs

First Installment

WHEN metal freezes in a mold three things commonly are observed to occur. The casting is smaller than the pattern, it contains a cavity and the metal is under stress. Sometimes there is also a *settle* or depression in the top of the casting. All these are manifestations of the decrease in volume of the metal as it cools, freezes and cools further.

A little reflection will show that if metal could be caused to freeze so slowly that it remained of one temperature throughout, the skin not freezing before the center for instance, then the contraction of the liquid metal merely would cause the mold to be less than full as the metal cooled but once solidified the object would change dimensions in uniform proportions throughout and neither voids nor stresses would occur but only settling and change of dimension from pattern size. It is therefore clear that the temperature distribution within a cooling casting is of fundamental importance in connection with shrinkage.

Methods exist[1] for determining the temperature distribution in symmetrical solids under reasonably simple cooling conditions. In the beginning we will consider the most symmetrical form of casting, the sphere. The cooling (or heating) rate of a substance is measured by a physical constant called *diffusivity* and usually represented by the symbol h^2. This constant varies greatly for different metals being greatest for silver, (1.737) and least for bismuth (0.0678) among the common metals. Therefore, it is necessary in considering the cooling rate of a body to know what its diffusivity is[2] by consulting a suitable table.

The temperature within a cooling sphere is further dependent upon the cooling rate of the surface which in turn is dependent upon the experimental conditions. We shall proceed to investigate the matter under certain cooling conditions for which mathematical solutions are possible.

Problem 1

REQUIRED: The temperature distribution in a sphere, that is, the temperature of any point distant, r, from its center at any time, t, after the sphere, originally of uniform temperature, has its surface cooled instantaneously by a given amount and afterward maintained at that temperature.

The mathematics[3] of the problem is such that a diagram can be constructed for its solution for any chosen radius of the sphere R.

Such a diagram is shown in Fig. 1. Here the vertical scale measures temperature, θ, *above*

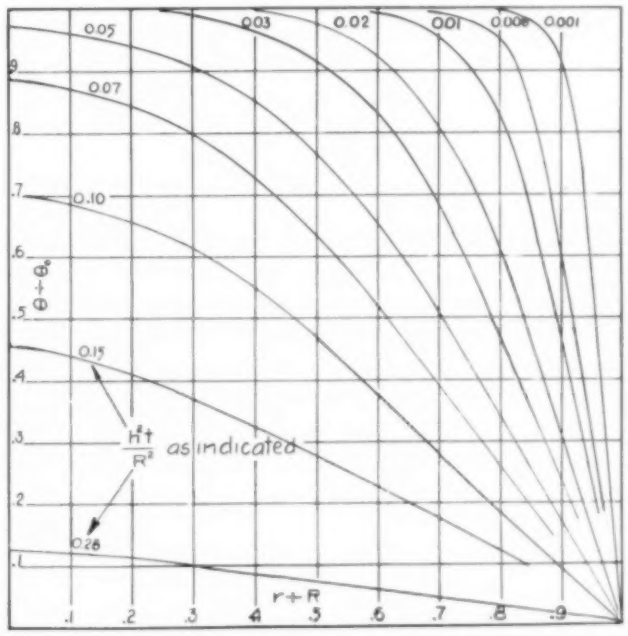
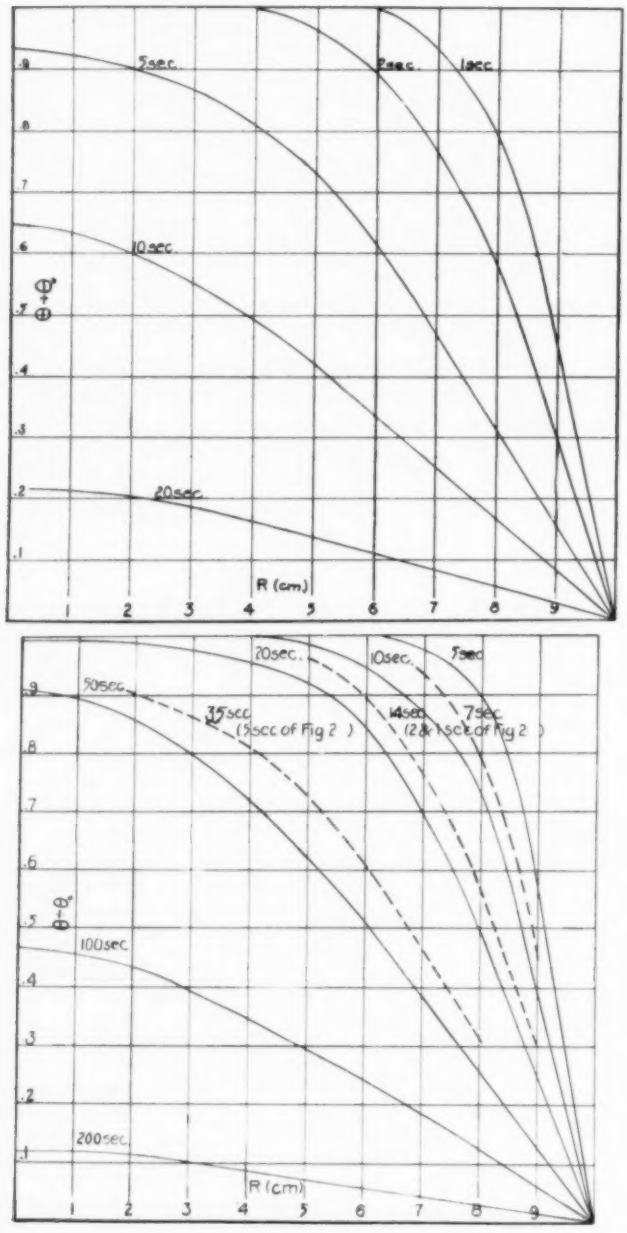


Fig. 1—Horizontal scale measures radial distance at any point from center of sphere as a fraction of the sphere's radius

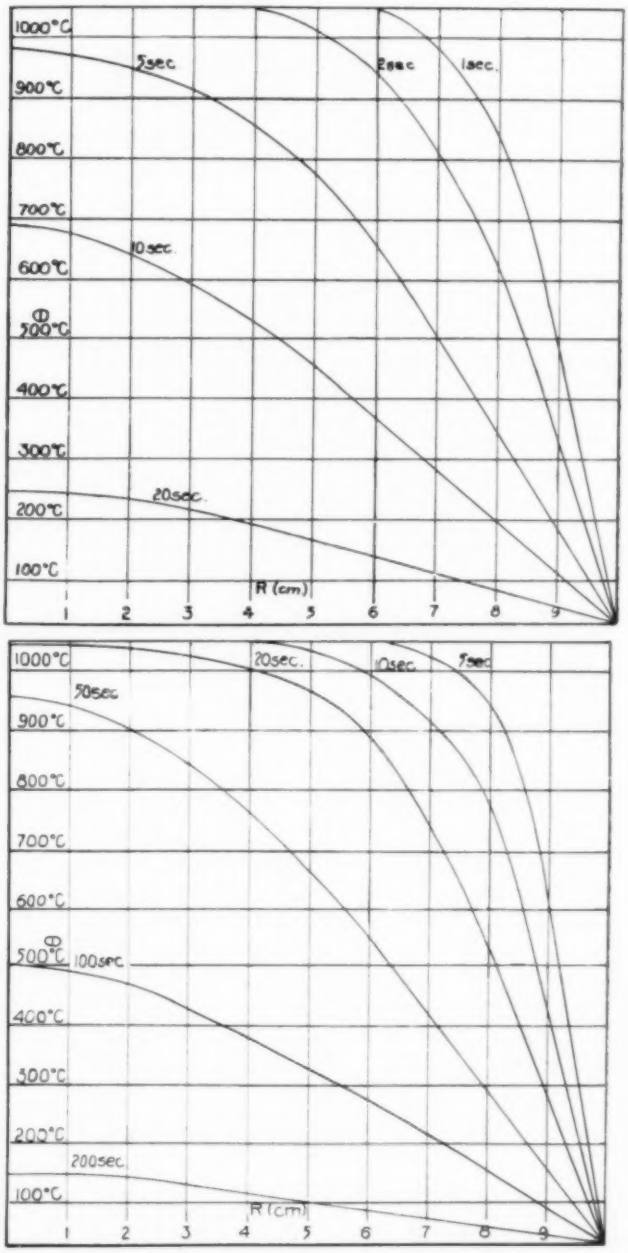
Footnote references will be found at the end of this installment on page 66.



Figs. 2 and 3—Temperature distribution of spheres of 10 centimeters radius having diffusivity of copper (1.333) and iron (0.175) both assumed constant at their values

that to which the surface is suddenly cooled. The temperature is *expressed as a fraction* of the original temperature, θ_0, similarly measured above the final surface temperature. The horizontal scale measures, r, the radial distance of any point from the center of the sphere *as a fraction of the sphere's radius, R.*

A separate line must be drawn, correlating temperature and radius with time for each value of $\frac{h^2 t}{R^2}$. For a sphere of known radius, R^2, and diffusivity, h^2, one readily may select that line corresponding to any desired time. It is plain that in a sphere of given radius the time when a chosen point reaches a given temperature is inversely proportional to the diffusivity of the material of the sphere. The time required for a point distant from the center of a sphere by a given *fraction of its radius* to reach a given temperature is directly proportional to the square of the radius for spheres of the same material but differing in size. Figs. 2 and 3 show the temperature distribution in spheres of 10 centimeter radius having respectively the diffusivity of copper (1.333) and iron (0.173) both being assumed constant at their values. The curves of Fig. 2 would be found exactly duplicated in Fig. 3 a times $\frac{1.133}{0.173} = 7$ (very nearly) times as great. A few such curves are dotted in for comparison with the family of curves computed directly. To adapt Figs. 2 and 3 (*Please turn to page* 65)



Figs. 4 and 5—Temperature distribution of a copper and an iron ball of 10 centimeters radius on cooling from 1050 to 25 degrees Cent.

Castings Exhibited At A. S. M. Show

Fine types of cast parts gave a high rating to ability of foundries

Artistic arrangement accorded an attention value and impressed the observer with the quality of castings

INTERESTING and indicative of the merchandising trend in cast metal products was the number of foundries exhibiting at the National Metal Exposition held in Chicago, Sept. 30 to Oct. 4, 1935. Thirteen foundry firms arranged interesting displays of their products. In addition, nine material and supply (*Please turn to page* 58)

MUSICAL BELLS

By MRS. A. S. C. FORBES

Los Angeles

Mrs. A. S. C. Forbes

I HAVE been requested by the editors of THE FOUNDRY to tell something about my method of casting musical bells. Bell making, as an art is nothing new for it was one of the earliest trades in metal work. However, to design and make a certain bell with musical tones may be considered new and even novel. Success in that line depends not alone on the designer but also on the pattern maker. An expert pattern maker for musical bells is as rare as a perfect bell.

A perfect musical bell depends upon its proportion, which affects the pitch, high or low. It also depends on the prescription in the metal mixture, which affects the clearness of tone, and the heat at pouring which affects the entire character of the bell. From experience we have evolved a standard which produces a musical tone to all my bells, large or small.

My line of bell making is confined principally to replicas of the old church bells that were used in the missions of early California. The mission bells were brought here by the Franciscan friars and were furnished to them by order of the King of Spain, Carlos III, who allowed two bells to each mission, one large and one small. Aside from these church bells, to be used in the towers of the missions, the priests brought different kinds of small bells for use in church services, some of which were decorated elaborately with fanciful crosses and religious inscription. It is these large and small bells that we copy as souvenirs, and for use in memorial chapels, church towers and for California ranches.

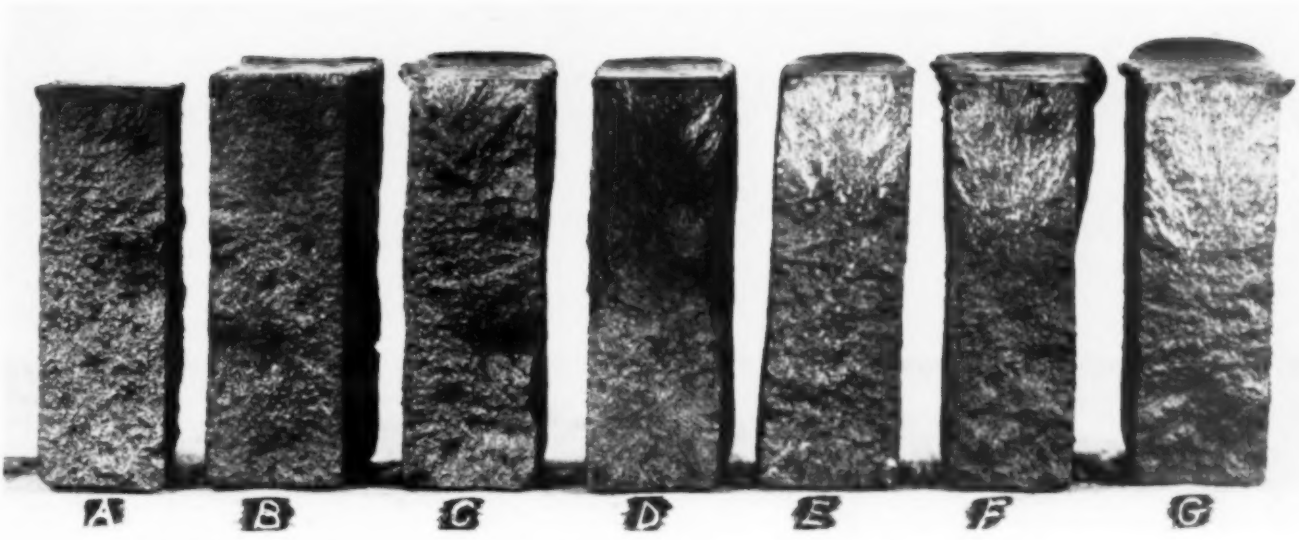
A corner in the workshop of the bell foundry operated by Mrs. Forbes in Los Angeles. Cecilia Parker, motion picture actress, is examining the bells. Illustration courtesy Copper & Brass Research Association

Copying the bells was first a pleasure or hobby which later became a financial benefit. It is an individual business, as no other state but California has a field for such endeavor. The designs are made in the usual manner of copying by measurement, reduction and proportion. If a customer wants a bell like the one hanging in the campanile of Mission San Gabriel Arcangel he gives the diameter at the rim of the size he wishes and we do the rest. A photograph of the bell hanging in the campanile is taken and enlarged. From that picture we make the design for the pattern in proper proportion to the size of the bell, beginning with the measurement at the rim that the customer has given me.

The souvenir bells range in size and weight from 2 inches high to 5 inches and from one and a half ounces to four in weight. They are plain or decorative according to the original bell copied, and are all made of bell metal.

A few of the old bells have never been removed from the bell towers since they were hung there by the padres with the help of the Indians. However, most of them have been taken away and many of them that are left are cracked, broken and greatly worn, but they are cherished as valuable relics of the mission days when the padres were lords of the land and the Indians were the chosen people.

Winner of Third Prize in The Foundry's Award Contest



Silicon content of the iron and therefore the relative hardness is indicated by the depth of chill on the sample test block

ADOPTS TEST BLOCK CONTROL

By HENRY P. BIEGEL
Allis-Chalmers Mfg. Co., Milwaukee

CONFRONTED many years ago with the necessity of knowing the grade of iron in the ladle before receipt of the analysis from the chemical laboratory I adopted the method described and illustrated herewith. This is a practical method for determining the quality of the iron in a day's run as it comes down from the cupola. The method is applicable from the softest to the hardest kind of iron required for the different classes of iron castings.

Many foundries employ the same or a somewhat similar technique with satisfactory results. However, this description is intended for those who have no practical method for testing the quality of the iron at the actual casting time. Adoption of the method will prevent many disappointments which are sure to follow unsatisfactory procedure in this phase of foundry practice.

The principle of the test is based on the silicon content of the iron which is reflected by the depth of chill, or lack of chill as shown in the broken test block. The test block is ¾ x 2½ x 5 inches and is poured with the narrow face against a chill and in an open mold. When the block has cooled to a dark red it is quenched slowly in oil and finished cooling in water. The block then is broken with a hammer and the quality of the iron is indicated by the characteristic appearance of the fracture. The following features correspond to those in the test blocks shown in the accompanying illustration:

Henry P. Biegel

	Silicon, per cent	Depth of chill
A	2.25	.....
B	2.00	.....
C	1.75	⅛-inch
D	1.50	¼-inch
E	1.25	½-inch
F	1.10	¾-inch
G	1.00	1-inch

The observer will note that when melting a soft iron of about 2.25 per cent silicon, there will be no trace of any chill. When the iron reaches a 2.00 per cent silicon content, a very slight chill, just a white line will be noticed. At 1.75 per cent silicon the chill depth will be about ⅛-inch. With a 1.50 per cent silicon content the test block will show from ⅜ to ½-inch chill.

One thing must be kept in mind (*Please turn to page* 82)

Fig. 1 — Metal is melted in stationary furnaces fired with natural gas

Overcoming Gas Conditions In Phosphor Bronze

By M. T. GANZAUGE

Goulds Pumps, Inc., Seneca Falls, N. Y.

IT IS quite simple to cast phosphor bronze cylinder linings approximately 3 feet long and 1½-feet in diameter, but it is sometimes a problem to have them come absolutely free from any holes or dross on the inside and outside surfaces after machining. Why, without any change in melting and molding procedure these castings should turn out suddenly to be defective after hundreds of them had been cast successfully, provides an interesting study.

Ingot metal purchased in carload lots from a reputable secondary metal company is used. As part of a standard practice an analysis is taken from every lot. This shows nominally a mixture of 80 per cent copper; 10 per cent tin, 10 per cent lead and 0.10 per cent phosphorus.

Stationary natural gas furnaces of the surface combustion type are used with No. 80 graphite crucibles as shown in Fig. 1. Starting out with a cold furnace and a cold pot a heat of 250 pounds bronze is melted in 1¼ to 1½ hours. Subsequent heats with furnace and crucible hot are melted in 50 to 55 minutes. The variation in time depends upon the conditions of the furnace walls (new furnace linings expedite melting by 10 to 20 per cent) and also by the shape of the scrap castings, gates and risers used with the ingot metal. Care always is taken to assure that important and difficult castings are not poured with first heats which are subjected to the longer melting time.

A proprietary flux is employed, but no charcoal or deoxidizers such as phosphor copper or phosphor tin are used. Temperature of the metal is checked with a standard type portable pyrometer. After it has reached 1950 degrees Fahr., the metal immediately is removed from the furnace, skimmed carefully and poured into the molds. As a safeguard for correct pyrometer reading, the melter's pyrometer is checked regularly at the beginning of each week by the foreman, sometimes even twice a week with a master pyrometer that has its per-

Fig. 2—Sections of the cylinder lining showing condition of the castings

manent place in the plant physical laboratory.

In addition, each furnace is provided with a clock dial placed in a prominent place. In starting the heat, say at 9 a. m., the melter sets the hands of the clock at that hour. He knows that in about 50 minutes a heat of 250 pounds of bronze should have a temperature of 1900 to 1950 degrees Fahr. He, therefore, must shut off the fire at 9:50 a. m. and check the temperature. If the proper temperature has not been reached, the fire will be turned on again but the dial clock is a constant reminder to guard the metal from becoming overheated and at the same time eliminate any guess work.

As shown in Fig. 3, the cylinder lining is cast two up in a vertical position. Gates are arranged tangentially on top and bottom. Runners are sufficiently small to choke the flow of the metal whereas the gates leading into the castings are larger (2 : 1 in proportion gate

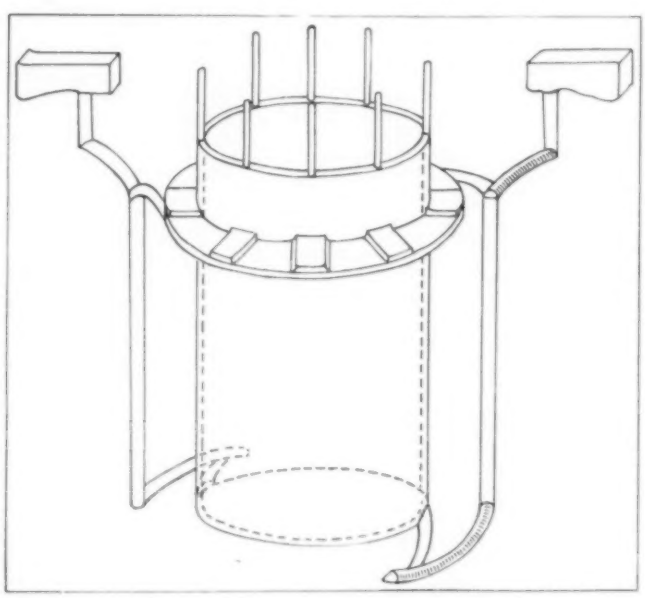


Fig. 3—The cylinder lining is cast two up in a vertical position. Gates are arranged tangentially on top and bottom

to runner) to permit the metal to fill the mold cavity with the least amount of turbulence.

As the metal reaches the top flange the second set of gates becomes effective and supplies the casting with hot metal. If only bottom gates were used, the metal would be quite sluggish by the time it reached the top. However, with

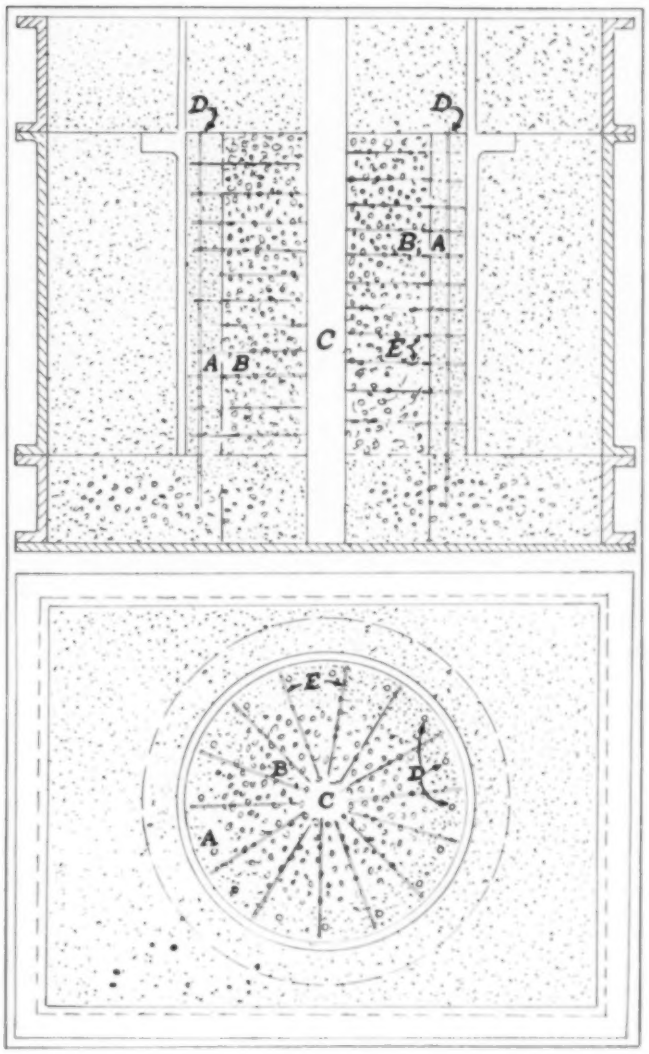
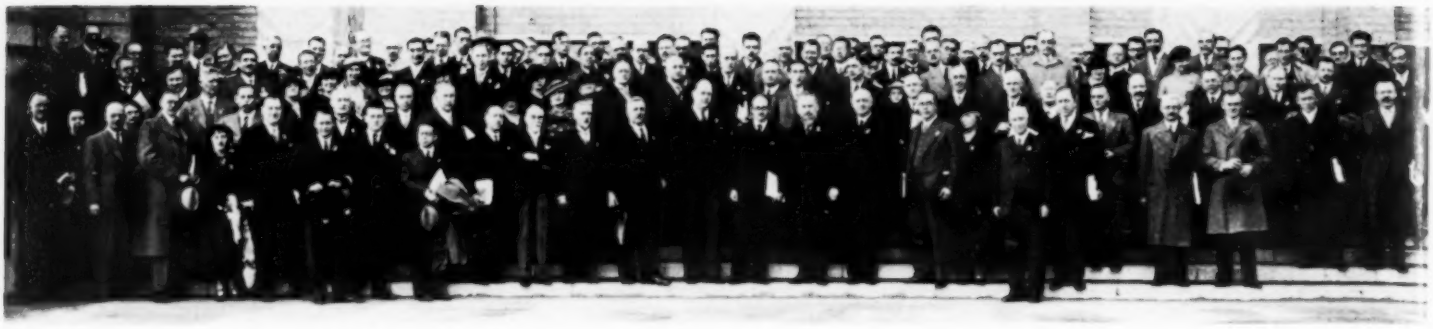


Fig. 4—The core of the cylinder is an integral part of the drag section of the mold

the second set of gates, the metal will stay liquid longer in the mold, will wash any scum or loose particles of sand through the top and allow entrapped air bubbles to escape through the overflow ring. This ring, which is somewhat in the nature of a riser, is cut off by the machine shop before the casting is machined. Examination of this piece frequently shows dirt and air bubbles, which otherwise would have remained in the casting itself. A number of ½-inch whistlers are placed on top of this overflow ring to allow a (*Please turn to page* 70)

Fig. 5—Sections of sprue heads under (1) neutral, (2) oxidizing and (3) reducing furnace conditions



FOUNDRYMEN MEET IN BRUSSELS

Eighteen Countries Represented

By VINCENT DELPORT
European Manager, The Foundry

IN VIEW of the recent tragic death of Queen Astrid of Belgium, the European foundry congress held in Brussels from Sept. 19 to 26 was conducted on strictly business lines, the only exception being the official banquet, which took place on Sept. 25 by special request of H. M. the King, who expressed the desire that the function should not be cancelled.

A personal touch was given to the proceedings by the announcement at the close of the technical sessions that the dignity of Chevalier de l'Ordre de Leopold had been bestowed upon J. Leonard, manager of Societe d'Angleur-Athus, president of Association Technique de Fonderie de Belgique, and president-elect of the International committee of foundry technical associations, for his work and efforts in support of the foundry industry and technical education. In presenting the decoration to Mr. Leonard on behalf of the Belgian association, the secretary, R. Deprez, mentioned that the recipient had devoted 25 years of his life to the industry.

Molders Are Highly Skilled

Replying, Mr. Leonard referred to the first meeting of Belgian foundrymen at Liege, 24 years ago. He said that at that time molders were skilled artisans, and that their professional qualities had never been surpassed. Considerable progress has since been made, thanks to the co-operation of all those who were really devoted to their trade. He expressed his thanks to the representatives of foreign associations present who showed their appreciation of the honor that had been bestowed upon him.

At the banquet held at the end of the congress, Paul Ropsy, past-president of the Belgian association and first president of the International committee of foundry technical associations, presented Mr. Leonard with a miniature jewelled replica of the decoration of the Order of Leopold.

The congress, attended by about 430 people representing 18 countries, was opened by J. Leonard on Friday, Sept. 20, in a hall of the Universal and International Exhibition, held in Brussels from May 1 to Oct. 31. Mr. Leonard welcomed the delegates and expressed the hope that each one could benefit from the technical discussions and the works visits. He referred to the present position of the foundry industry in Belgium and mentioned that, while full advantage is being taken of all modern developments, the Belgian foundries remain adapted to the methods of production required by a comparatively limited output.

Sessions for Foundry Foremen

K. Gierdziejewski, president of the Polish foundry technical association and president of the International committee of foundry technical associations, replied on behalf of all the members of the International committee, representing foreign associations.

Four technical sessions were held in the afternoons of Sept. 20, 21, 24 and on the morning of Sept. 25. On the morning of Sept. 22 a special session was held for the benefit of foundry foremen, during which a number of papers were given on the following subjects: Classification of irons and steels; foundry equipment; control of sands; control and operation of the cupola; determination of temperatures; verification of the properties of castability; ramming of sand in molds; cast iron test-pieces; examination ot wasters.

During the congress, works visits were paid to Fonderies Nestor Martin, stove manufacturers, S. A. Union des Acieries, at Marcinelle, the laboratories of Ecole des (*Please turn to page* 74)

Fig. 1 — Pavement produced with triangular cast iron elements

Iron Reinforces Concrete Roads

CONSTANTLY increasing demands made upon highways have aroused considerable interest in various countries in the development of roads having greater wear resistance and therefore lower maintenance charges. Cast iron has been accorded considerable attention in these studies, either as a paving block or as a reinforcing medium for concrete or macadam. Several previous articles in THE FOUNDRY describe installations of cast iron paving materials, including a test section at the University of Minnesota, Minneapolis.

Recently the Italian National Fascist Association of Metallurgical Industries has published a booklet entitled *Armature e Pavimentazioni Metalliche*, describing several types of metal reinforcing, including those made of cast iron. The following discussion is abstracted from the section of that publication on cast iron. The accompanying illustrations are reproduced through the courtesy of that association.

Metallic Grid Simplifies Paving

To eliminate the inconvenience of joints, which on plain concrete roads usually require careful execution and maintenance, to reduce the thickness and hence the volume of material to be hauled to the job and to be mixed, and to reduce the weight of the paving itself, some road builders have given some thought to reinforcing the road surface with some other means than a netting made up of small rods. By placing a metal lattice with uniformly spaced openings on a resistant sub-base, which may be an old substructure like macadam or a layer of thin concrete, and then filling these openings with conglomerate cement, these objects may be accomplished with comparative ease.

The skeleton grid imparts other advantages to the pavement besides those of a continuous and thin layer. Due to the high thermal conductivity of metal (from 40 to 50, as against 0.7 to 1.5 for concrete), temperature is more uniform throughout the paving. Subdivision of the concrete into numerous small sections eliminates the effects of shrinkage accompanying setting of hydraulic binders and the superstructure becomes more elastic. The surface is less subject to wear since one part of the structure projects above the other. The surface also is rougher as the wear is less uniform due to the difference in the characteristics of the materials employed. Finally, construction operations are much simpler and more quickly accomplished, since, in so far as the concrete is concerned, the use of expensive materials and constant attention to careful mixing is eliminated.

Based on such conceptions, the metallic grid may be given a variety of forms. The metal may be ordinary cast iron or soft steel. The total weight of the (*Please turn to page* 68)

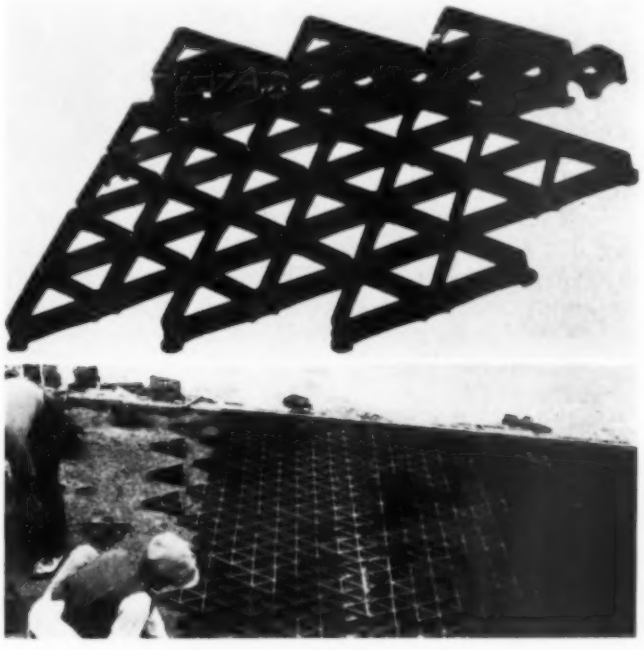


Fig. 2 (Above)—Construction of the ILVA system of reinforcing. Fig. 3 (Below)—Method of laying the cast iron sections

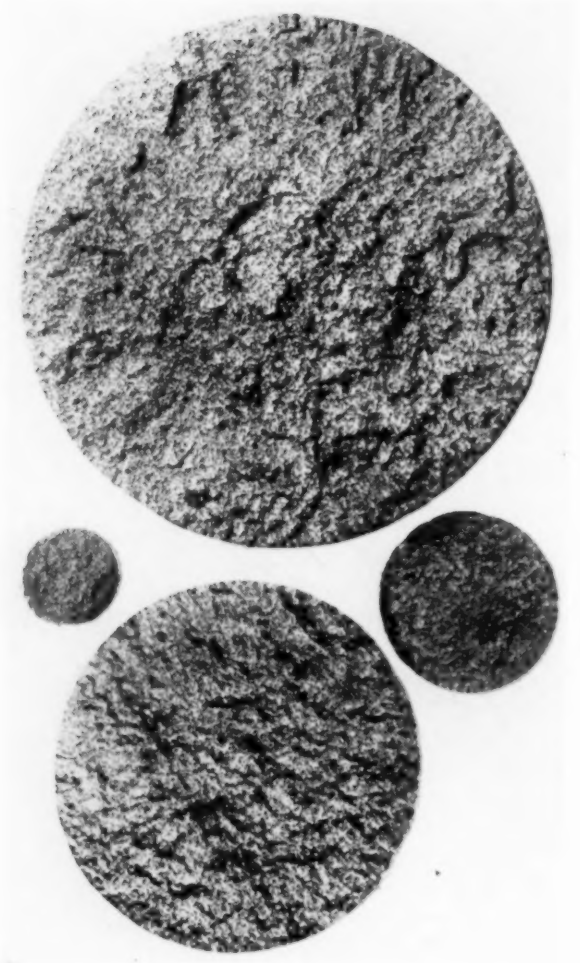


Fig. 71—Fractures of low carbon alloy free iron poured from the same ladle

GRAY CAST IRON

By JOHN W. BOLTON

Chapter VI (Effect of Special Elements)

A NUMBER of special elements, usually called *alloys*, are added deliberately to modify or to improve the properties of gray irons. Pig irons may contain small amounts of elements, such as titanium, copper, etc. Although these often are unrecognized, they may affect the properties of the metal. Scrap may contain various elements such as nickel, chromium, copper, tin, zinc, etc.

A vast volume of research work has been done in the study of the effects of special elements. In spite of this work, present knowledge concerning the effects of many such elements is cursory and imperfect. Comparatively few studies cover the effects of the addition or additions on a comprehensive series of classes of cast iron. In many cases the researches have been confined to laboratory experiments of doubtful practical significance.

About 2 per cent of American cast irons contain deliberately added alloys. At present, the more important of these are nickel, chromium and molybdenum. Other additions of commercial utility are aluminum, copper, titanium, vanadium and possibly one or two others.

Without doubt many times special elements have been and are utilized in an unscientific and uneconomical manner. Thousands of dollars have been wasted in using alloys as cure-alls, where a little applied metallurgical knowledge would enable production of satisfactory and high grade material at low cost. Nevertheless, the steady and continued increase in applications of alloys to cast iron is proof that in many cases they have practical and economic justification.

The logical method of approach to the problem of composition is first to learn how to produce the very best base iron for the purpose in view, and then modify it if necessary by intelligent use of alloys. The one indispensible ingredient in all foundry mixtures is brains.

Table III summarizes in a general way some of the more important effects of the nongaseous elements found in cast iron.

Nickel is a silvery gray metallic element, the atomic weight of which is 58.69 and density,

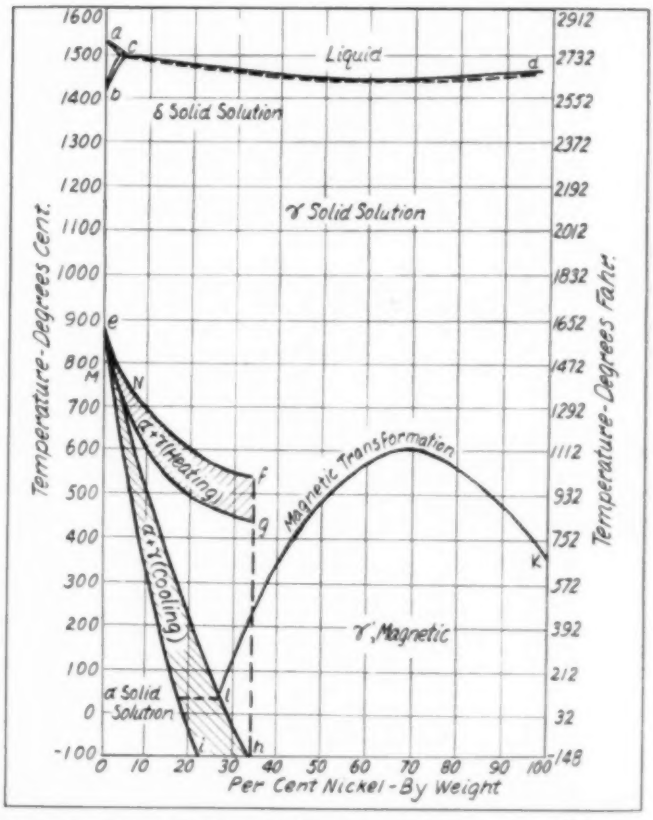


Fig. 72—Iron-nickel equilibrium diagram according to Merica in National Metals Handbook

8.85. Its crystal lattice is face centered cubic (parameters 3.51A). Commercially pure cast nickel is ductile, 25 per cent elongation in 2 inches and has a tensile strength of about 65,000 pounds per square inch. Brinell hardness is about 90 (3000 kilograms). Pure nickel melts at 2645 degrees Fahr.

In some respects nickel and iron do not exhibit great differences in physical constants. The molecular weight of pure iron is 55.84, density, 7.88, and melting point 2786 degrees Fahr. Nickel is slightly stronger, less ductile and harder than pure iron. Pure iron has a body centered cubic lattice at room temperature, whereas pure nickel has a face centered cubic lattice, similar in construction to, but slightly more compact than the crystal lattice of gamma iron.

Effect of Nickel on Iron

The iron-nickel equilibrium diagram is shown in Fig. 72. Iron and nickel form a continuous series of solid solutions. There is no great variation in melting points from one end of the series to the other. The minimum, at 65 per cent nickel, is but slightly below the melting point of pure nickel. Hysterisis in the transformations of this series of alloys below 1650 degrees Fahr. is so marked that certain phenomena remain subjects for argument and discussion even today. As is quite evident from the composite diagram, prepared by Paul D. Merica, nickel increase lowers the transformation range, alpha to gamma iron, and in the presence of 35 per cent or more nickel the gamma structure is retained at room temperature. The huge hysterisis area, *e, f, h*, shows that the conditions of cooling and heating have much to do with the structures which may be obtained. The reversal of nonmagnetic to magnetic gamma, line *l-k*, while interesting, is beyond the nickel range of most value to cast iron metallurgists.

Nickel affects the iron carbon alloys in two ways. First, it lowers the austenite-pearlite transformation temperatures. Second, in the higher carbon alloys it acts as a mild graphitizer, lowering the stability of the free cementite. The iron-carbon-nickel system has been investigated by Kase—*Scientific Reports*, Tohoku Imperial University, Vol. 14, No. 2, page 173, 1925. The iron-nickel-carbon diagram is shown in Fig. 74. The carbide of nickel is endothermic, and evidently quite unstable. It does not appear in the presence of iron, manganese, chromium, etc., whose carbides are more stable. Therefore, in iron-carbon-nickel alloys the nickel occurs largely in the ferrite.

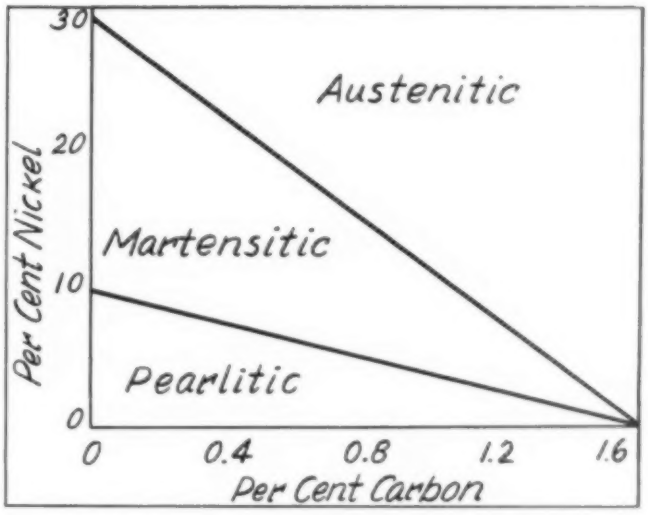


Fig. 73—Nickel-steel constitutional diagram, according to Guillet

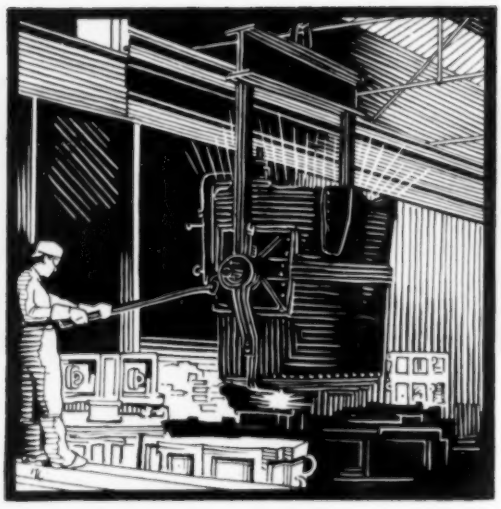
Effects of nickel on the structure of the lower carbon iron-carbon alloys (steels) is illustrated in an approximate manner by the diagram of Guillet, Fig. 73. If for the moment gray cast iron is considered as having a matrix similar in many respects to steel, it is noted at once that at about 0.80 per cent combined carbon the matrix becomes largely martensitic at somewhat above 4.5 per cent nickel. Over about 16 per cent nickel the matrix becomes largely austenitic, and nonmagnetic. (*Please turn to page* 81)

TABLE III

Effects of Nongaseous Elements in Gray Iron

Effect of Addition or Increase	Silicon	Manganese	Sulphur	Phosphorus	Nickel	Chromium	Molybdenum	Aluminum	Copper	Tin	Titanium	Vanadium
Initial solidification temperature	Dec.	–	–	Dec.	–	–	–	–	–	Dec.	–	–
Eutectic solidification temperature	Inc.	Dec.	–	Dec.	N.C.	Inc.	N.C.	–	Dec.	Dec.	–	–
Carbon content of eutectic	Dec.	Dec.	–	Dec.	N.C.	Dec.	N.C.	Dec.	Dec.	–	–	–
Eutectoid transformation temperature	Inc.	Dec.	–	N.C.	Dec.	Inc.	Inc.	Inc.	Dec.	N.C.	–	Dec.
Carbon content of eutectoid	Dec.	Dec.	–	Dec.	Dec.	Dec.	Dec.	Inc.	Inc.	–	N.C.	Dec.
Stability of carbide	Dec.	Inc.	Inc.	N.C.	Dec.	Inc.	Inc.	Dec.	Dec.	N.C.	Dec.	Inc.
Condition of graphite	Unf.	–	–	N.C.	Imp.	–	Imp.	N.C.	–	–	Imp.	–
Fineness of pearlite structure	–	Inc.	–	–	Inc.	Inc.	Inc.	–	–	–	–	–
Fluidity at a given temperature	Inc.	–	–	Inc.	–	Dec.	Dec.	Dec.	–	–	Inc.	–
Strength	Dec.	N.C.	–	N.C.	N.C.	Inc.	Inc.	–	–	–	–	Inc.
Impression hardness (brinell)	Dec.	–	Inc.	Inc.	Inc.	Inc.	Inc.	Dec.	Dec.	Inc.	–	Inc.

Inc.—Increase
Dec.—Decrease
Imp.—Improve
Unf.—Unfavorable
N.C.—Negligible Change—indicates slight change when special element is added in usual amounts.
*Note—This table is a general guide, applying only to ordinary gray irons.



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Unit To Promote Combustion Requires Heat Resistant Metal

We are forwarding a combustion chamber, made up of four castings, that is placed on top of the grate in a stove or furnace to promote more intense combustion of the fuel. The upper section of this chamber burns off in service and we shall appreciate your advice on the best type of iron to employ.

Since the combuster occupies a position where it is surrounded by incandescent fuel we doubt if any type of casting will last long. Grate bars and other castings subjected to somewhat similar conditions show increased life when made from hard iron of the following approximate analysis: Silicon under 1.00 per cent, sulphur 0.10 per cent, phosphorus 0.30 per cent, manganese 0.70 per cent. The addition of a small amount of chromium 0.50 to 0.60 per cent increases the heat resistance. If the price received for the castings warrants the expense you might use a high heat resistant metal containing 15 per cent chromium.

Hard Sand in the Drag Prevents Escape of Steam and Gas

We are sending two brass castings made from an alloy containing 80 per cent copper, 3½ per cent tin, 6¾ per cent lead, and remainder zinc. These castings do not have any strength; in fact, they break as if the metal was rotten. Will you give us your opinion as to the cause and remedy?

Section of casting sent for our examination indicates that it probably was made on a squeeze type molding machine with a shallow flask for the drag. Since the rough surface mentioned is found only on the lowest portions of the casting, it is our opinion that the roughness results from squeezing the mold too hard or from the bottom board being rubbed on too tight. Either of those will prevent proper escape of the steam and gases generated when the hot metal is poured into the mold cavity.

We also note that the casting in not being fed properly as it contains some shrinkage voids in the heavier section where the lower flange meets the section at right angles to it. We believe that the shrinkage problem can be met by making the gates about the same thickness as the flange into which they lead.

Nickel-Copper-Chromium Alloy for High Temperatures

We have been asked for a rust resisting cast iron plate into which an electrical heating element is to be cast. These plates are to be used in the manufacture of synthetic resin products and are subjected to 950 degrees Fahr. Will you advise us what composition would be suitable?

While the temperature of 950 degrees Fahr. seems extremely high for molding synthetic resin products, our recollection being that 350 degrees Fahr. is the maximum, we believe that you will find a composition containing about 15 per cent nickel, 7 per cent copper, 2 per cent chromium with the usual silicon, manganese, etc. as found in gray iron will prove suitable for your purpose. It will serve particularly well if the temperature is as high as you mention. That alloy iron is sold under the trade name Ni-Resist. Further information on it may be obtained from the International Nickel Co.

Flow Quantity of Brass Over Iron Casting in the Mold

We want to make cast iron locomotive shoes and wedges which must have ½-inch of brass cast on. How is that accomplished?

Wedges and shoes should contain dovetails or holes in the surface, against which the brass will be poured. They must be absolutely free

from rust, scale, grease and dirt which will cause blows. In addition the iron castings should be quite warm, hot enough to prevent deposition of moisture, but not too hot, before the brass is run in. In the case of small castings they are heated before being placed in the mold, but in the case of heavier ones, the heating may be accomplished by flowing a quantity of brass over the surface first. That is performed by making the pouring sprue considerably higher than the riser. You will have to experiment to determine how much brass will have to be flowed through to obtain the desired results, and when that point is reached pouring is stopped.

Opinions Differ on Merits Of Smooth and Rough Top Ingots

We have heard many arguments in favor of smooth top ingots of brass as against rough top ingots. We would appreciate your opinion.

Relative merits of smooth and rough top ingots have been discussed widely. Obviously the top of the ingot, if it is not artificially smoothed by a chill, can indicate something as to the condition of the metal when poured into the ingots. Whether the ingots produced by either method are going to produce, when remelted, good castings or bad, is not a question of whether the top is smooth or rough.

There are those who claim that smooth top ingots reduce the melting loss when the ingots are remelted. This saving in loss may or may not be a fact, because if it is a fact, the saving is so small that it is hard to find. There is value in the smooth top ingots in their ease of being stacked for storage and in their saleable appearance. The rough ingots, however, may indicate to one who is versed in the casting of ingot metals, something of the history of the metal in the process of refining. However, this is a negligible characteristic when considered from the standpoint of value of the ingots in producing good castings upon being remelted in the foundry.

Nomenclature of Gating Terms Presented in New Book

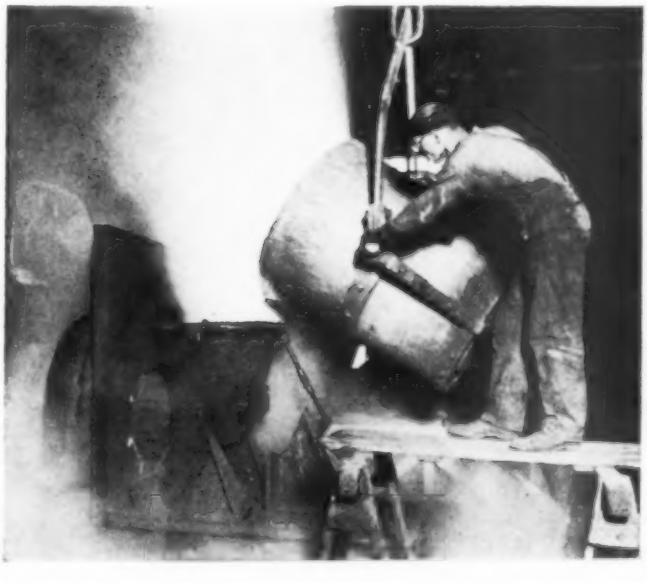
Is there a standard nomenclature for foundry and pattern practice? Among patternmakers I find that the terms gate and runner are used synonymously. Also I find that the channel from the sprue or pouring basin is called either a gate or runner and when the casting is taken from the sand this excess metal is called a sprue.

This particular phase of the gating subject is covered in Chapter II, *Gates and Risers for Castings*, by Pat Dwyer, published by the Penton Publishing Co., Cleveland. In 1931 a committee was appointed by the American Foundrymen's association to draw up a list defining and clarifying gating terms. Recommendation of this committee was published in the *Transactions* of the association, page 510, vol. XL, 1932. The report included a chart showing 15 different types of gates with terms for the various parts. Briefly and in a general way the gate is the opening leading into the mold, the runner is the passage between the gate and the sprue, and the sprue is the upright passage or funnel into which the metal is poured from the ladle. Custom and tradition have sanctioned the use of the same terms when applied to the patterns for these parts and also to the metal which fills them after the casting has been made.

Suggests Sea Coal Facing To Eliminate Rough Surfaces

We are having trouble getting a smooth face on theater end standards. Can you suggest a facing formula for us to use; a shake-on or some means of eliminating this trouble? We are using a facing now but the iron when hot enough to run the casting, will burn into the sand and leave a rough surface.

We believe that the trouble you are encountering with rough surfaces on your theater seat end standards can be overcome by the use of seacoal facing sand. The proper amount of seacoal to be added to the facing sand may range between 10 parts of sand and 1 part of seacoal to 20 parts of sand and 1 part of seacoal. You should do a little experimental work to determine the best proportion. In making up the facing sand, it is suggested that you use 4 parts of old sand to 1 part of new sand, and after mixing thoroughly add the seacoal. Mix thoroughly again to insure a uniform distribution of the seacoal throughout the facing sand mixture. In using the seacoal facing, only place enough over the pattern to give a thin, uniform covering.



Hard Spots May Be Due to Galvanizing

We are operating a black-heart malleable foundry in Australia and are sending for your comments, a piece of a pipe fitting which is extremely hard to machine although it looks all right.

The fractured piece of the fitting sent us has been galvanized, and you do not mention whether hard machining also is encountered with plain or ungalvanized fittings. If the trouble is found only with the galvanized pieces, it is advisable to check into the galvanizing operation to see that the bath is not maintained at too high a temperature. It should be below 900 degrees Fahr.

If it goes above that point there is a possibility of some of the carbon going back into solution, and reprecipitating as cementite. However, it appears that your trouble may be due to a heavily decarbonized surface which means that the metal at that point is practically pure ferrite. Such material is soft, but extremely tough so that in machining it is removed in long curls rather than in short chips. In tapping, which is the machining operation, the long curls clog the flutes and cause difficulty.

Metal Absorbs Gases During Melting

We are making castings to the following specifications: Copper, 77 per cent; tin, 8 per cent, and lead, 15 per cent. We are having trouble with the lead sweating. Also, we find that where lead has segregated, the surface is left porous after the casting has been finished. Castings weigh from 5 to 200 pounds each. Can you give us any information which will assist in overcoming these troubles?

The specification is a common, high lead bearing alloy and should give no trouble. Some have ¼ of 1 per cent nickel in it, which increases the melting point and consequently increases the temperature at which it must be poured, but also it raises the temperature at which it sets. A high setting or solidifying temperature means the setting of the large mass of metal soon after pouring and the imprisonment in this solidified mass of the low melting point lead or lead-tin constituent. This is a cure only for the symptom of the diseases. The disease is gas in the metal, dissolved during melting.

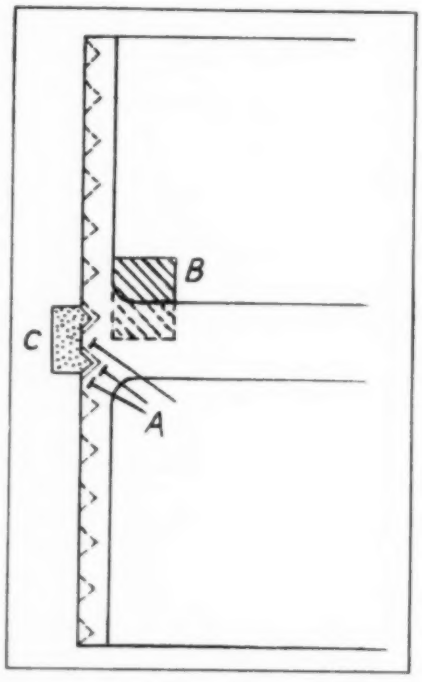
Gases, upon being released during solidification, pass to the surface, opening up microscopical passageways through which the constituent, still molten after the major part of the alloy is solidified, may pass to the surface and result in what is known as lead or tin sweat. The cure is to melt the metal so that gas absorption is eliminated. Where the gases have been burned completely by an ample supply of oxygen, they are not soluble. Therefore, care must be taken to see that the gases are burned completely by maintaining perfect combustion in the furnace. An ample supply of oxygen at the burning temperature of the fuel will burn all the gases. However, if there is too much air to cool down the fire, the gases may not unite completely with the oxygen. Thus, it is evident that the highest possible speed in melting is more or less indicative of the best practice in combustion for a given furnace. Also high speed melting reduces the time during which the metal is exposed to furnace gases.

Grain Open at Opposite Ends of Arms

We are making a rope drive pulley 22 inches face and 5 feet 6 inches diameter. The rim is cast 2 inches thick and the 14 grooves are machined in it later. The pulley has six heavy arms and a heavy bead or reinforcing rib around the center on the inside. The grooves machino up perfectly with the exception of a spot opposite each arm where the metal shows a much opener grain than elsewhere. How can we secure dense, close grain metal at these points?

Since the metal section at the junction of the arms with the rim is thicker than elsewhere it will show an open grain under normal cooling conditions. The obvious remedy is to cool these areas artificially and thus secure a uniform rate of cooling throughout the entire casting. Several methods are available. The first and most obvious is to place a chill on the outside of the rim opposite each arm. However, this method has the disadvantage that the resulting metal in that area may become too hard and thus interfere with the speed of machining. Also the chilling effect will be greatest near the surface where it is not wanted, and will be least in the interior, or at the bottom of the groove where it is needed.

Three methods are shown in the accompanying illustration. They may be used singly or in combination. Singly for the production of a slight cooling effect; in combination of two or three where conditions are unusually severe. As shown at *A* a number of 6-inch spikes are inserted in the sand around the arm opening. The heads project to points close to the rim, but clear of the groove. Special wire coils may be secured for this purpose. Chill blocks of cast iron as shown at *B* may be rammed up in the sand at the junction of the arm to the rim. A small dry sand core *C* may be inserted in the outside face of the wheel opposite each arm. Projections on these cores extend into the metal almost the full depth of the anticipated machined groove. Thus instead of cutting deep into the metal at these points, the tool only will penetrate a short distance below the surface into dense, solid metal.

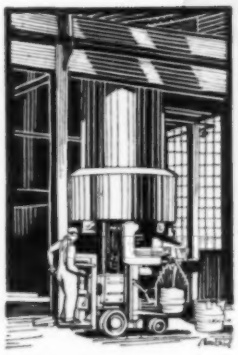


Three alternative methods for securing solid metal opposite arms

Ram Sand Harder On Points of Gear Teeth

In making small gears on a hand ram stripping plate machine we find that apparently there is a soft spot in the sand at the base of the teeth, which means that each tooth has to be chipped. I am wondering if there is a suction effect to the pattern which pulls the sand down in the teeth, thus creating these soft spots in the mold.

The soft points on the gear teeth are due to the same cause that produces soft spots on any castings, namely insufficient ramming. This is borne out by the fact that where the gears are rammed on a power operated jolt machine, the teeth are straight and true. On a hand rammed job the molder fills the teeth by throwing sand into them until they are filled to the top. Then he shovels in a course of sand and rams it fairly hard. The result is a soft streak around the points of the teeth. The remedy is to ram a thin layer of sand over the teeth, either with the rammer, or by throwing the sand on by hand in the same manner that the teeth are filled. Metal pressure is greatest at bottom of the teeth, therefore the sand in this aera should be rammed to a slightly greater density than elsewhere.



Viewing Foundry Developments . . . AT SHORT RANGE

POKERS and other tools used in the manipulation of a battery of pit furnaces in a mid-west nonferrous foundry are not left lying on the floor to trip the unwary, to interfere with freedom of movement, or to burn the hands of any person careless enough to pick one of them up by the wrong end. They are stacked primly and erect against the wall when not in use. Since the entire wall of the foundry building is made up largely of windows, the area in front of the furnaces is protected by a heavy wire screen on the inside to prevent the upper ends of the tools from breaking the glass. The screen also presents an irregular surface which prevents the tools from slipping sideways.

• • •

A line of Ni-Resist cookware, including a skillet cast of that alloy, recently was exhibited by the Chicago Hardware Foundry Co., North Chicago, Ill., at the New York House Furnishing show. The Ni-Resist cookware is said to carry an unconditional 20-year guarantee against warping, cracking or other effects of heat in normal household use.

• • •

SHRINKAGE and other difficulties encountered in casting crankshafts and camshafts is overcome by pouring in the usual horizontal position, and then before the metal solidifies, raising the mold to a vertical position. According to the patent describing the process, heavy blind risers or shrink bobs are placed at one end, and other strategic points so that these feed the casting when it is raised to the vertical position.

• • •

In a Pennsylvania brass foundry, a fan mounted slightly above the floor delivers a constant cooling breeze over the area in front of a battery of pit furnaces, the area in which the melter circulates while engaged in his regular duties. The fan is not needed in winter, but is highly appreciated in summer, when white hot pots, lifted in constant rotation from the furnaces throughout the day appreciably raise the temperature in the vicinity.

• • •

SINCE the first of the year a mid-west foundry has melted 6532 tons of malleable iron in a 5-ton rotary type powdered coal fired furnace. This is on the basis of approximately 25 tons of metal melted per day. Records show that less than 375 pounds of coal per ton malleable iron melted were required, that the refractory costs were approximately 45 cents per ton of metal melted, and that the over-all savings were about $4.00 per ton when compared with the cost of melting the same tonnage in an air furnace. It is claimed the complete investment was returned in less than 12 months.

• • •

A new alloy containing copper, zinc and silicon has been developed by the Doehler Die Casting Co., New York, especially for the die casting process. Physical properties secured are as follows: Tensile strength 65000 to 75000 pounds per square inch; yield point 30000 to 40000 pounds per square inch; elongation 20 to 25 per cent in 2 inches; reduction area 20 to 25 per cent; brinell hardness 110 to 120; impact strength 30 to 36 foot pounds; color, light yellow. The alloy is known as *Doler-Brass*.

• • •

Use of nickel and chromium in the ratio of 3 or 2½ to 1 gives a good tough iron in both the chilled and gray portions of a low-silicon, chill-cast iron according to a patent. Chill may be controlled by remembering that 1 point of carbon equals 3 silicon; 1 silicon equals 2 nickel; 2½ nickel equals 1 chromium, and 1 sulphur equals 10 silicon.

• • •

Ford Motor Co. has installed temperature regulation and air conditioning equipment in some of its machine shops and foundries. Reasons given include controlling the accuracy of fine machining operations, increasing the comfort of workmen and protecting processes from dust and dirt. While it is considered impossible to control the temperature exactly in the castings room because of heat radiated from ladles of molten metal while casting is in progress, the company has found it possible to reduce the temperature and humidity greatly and so increase the comfort of the men.

• • •

An interesting theory touching on the physical properties of cupola melted metal was introduced by a speaker at one of the sessions of the American Foundrymen's association in Toronto. He claimed that the slag exerts a strengthening and refining influence on the iron and quoted instances to prove that the iron from the first tap usually is inferior to the iron secured from later periods in the heat where the slag has had an opportunity to influence the quality of the metal.

• • •

ALUMINUM alloys containing magnesium in a suitable proportion as the hardener, are more resistant to corrosion than aluminum-silicon alloys. An alloy containing 3¾ per cent magnesium is used where service conditions require maximum resistance to corrosive attack. While the alloy is difficult to cast into intricate, leakproof castings, it is employed in the production of casting for sewage disposal plants, chemical plants, dairy equipment, etc.

• • •

A prominent eastern steel foundry reports highly satisfactory results with the use of a new air floated silica wash. It is claimed that economies effected in the cleaning room more than offset the high price of the material approximately ten times that of the ordinary variety of silica flour.

C. J. Leonard

Harold S. Austin

Scott Mackay

Men of Industry

CLEMENT JOSEPH LEONARD recently elected president of the International committee of foundry technical associations, was born at Bande (province of Luxemburg) on April 3, 1888. He graduated as a mining civil engineer from Technical high school of Liege in 1909 and now occupies the position of manager of the Grivegnee division of Societe d'Angleur Athus.

Mr. Leonard is a professor of iron and steel metallurgy at the Institut Gramme at Liege, and lecturer at the Ecole Superieure de Fonderie de Paris. He is president of the Association Technique de Fonderie de Belgique, president-elect of the International committee of foundry technical associations, to take office for the year 1936, president of the International Committee on Cast Iron Testing Methods.

Mr. Leonard also is an honorary member and vice-president of the Association Technique de Fonderie, Paris, and honorary member of the Institute of British Foundrymen. He has received the gold medal of the under secretary of state for technical education in France. He is a member of the Orientation Council of the University of Work, Charleroi, president of the Advisory Committee of the Foundry Section of Ecole Professionnelle de Mecanique de la Ville de Liege, president of the committee set up by the National Belgian Funds for Scientific Research for the study of the castability of cast iron.

Mr. Leonard has published a large number of technical papers dealing principally with defects in castings, the study of blowholes, and the Leonard effect, to which he has given his name, cast iron testing methods, the oxidation of cast iron, the study of ingot molds and the study of heredity in cast iron. In 1934 he headed a delegation of European foundrymen attending the International Foundry congress in Philadelphia.

WILLIAM FREDERICK DURAND, professor emeritus of mechanical engineering, Stanford university, recently was awarded the John Fritz gold medal for 1936 for notable achievement "as authority on hydrodynamic and aerodynamic science and in its practical application; outstanding leader in research and in engineering education."

HAROLD S. AUSTIN, whose appointment as foundry metallurgist and general foreman of cupolas at the Buick Motor Co., Flint, Mich., was announced in the October issue of THE FOUNDRY, was graduated from Rose Polytechnic institute, Terre Haute, Ind., in 1907 with a bachelor of science degree. Later he obtained an advanced degree in chemical engineering at that institution.

Mr. Austin's earlier experience and training were obtained with the following companies: Laclede Gas Co., St. Louis; Peoples Gas Light & Coke Co. and Underwriters' Laboratories, Chicago; American Steel Foundries, Granite City, Ill., and East St. Louis, Ill.; Hubbard Steel Foundry, East Chicago, Ind., and the Lackawanna Steel Co., Buffalo, N. Y.

For the past 17 years he has been connected with the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., as chief chemist and metallurgist and prominently identified with many developments.

SCOTT MACKAY, formerly associate professor of metallurgy, University of Wisconsin, Madison, Wis., has been made professor of ferrous metallurgy, Rensselaer Polytechnic institute, Troy, N. Y. Professor Mackay was graduated from Rensselaer Polytechnic in 1913 with the degree of bachelor of science and then entered the department of construction of Atlanta, Ga., as junior engineer. Later he spent some months in the blast furnace and steel mill plant at Ensley, Ala., and then joined the Anniston Steel Co., where he became engineering assistant to the manager. Shortly after the outbreak of the war, he was invited to become senior melter of the British Forgings Ltd., Toronto, then the largest electric furnace steel plant. He remained in that position until 1919 when he became associated with the Jones & Laughlin Steel Corp., Pittsburgh. Later he was made general superintendent of the Stowell Co., Milwaukee, and in 1925 was named production manager of the Globe-Union Mfg. Co.,

Milwaukee. He went to the University of Wisconsin in 1927.

Prof. Mackay is well known to many in the foundry industry, having taken part in numerous committee activities of the A.F.A. and other groups.

FRANK A. TRUEL, formerly general superintendent, has been made general manager of the Midway Foundry., St. Paul, Minn.

C. F. BURGESS recently has been elected chairman of the board and ARBA B. MARVIN, president, of the C. F. Burgess Laboratories, Inc., Madison, Wis.

JEROME STRAUSS, chief research engineer, Vanadium Corp. of America, New York, at its Bridgeville, Pa., plant has been placed in charge of all research and development work.

CHARLES A. FITZ-GERALD, sales representative of Sloss-Sheffield Steel & Iron Co., in the St. Louis territory for 20 years, also has been placed in charge of the Chicago territory.

ROBERT S. ARCHER, chief metallurgist, Chicago division, Republic Steel Corp., recently was elected president of the American Society for Metals.

Mr. Archer received his early education at Cass Technical high school, Detroit and his bachelor of science and master of science degrees from the University of Michigan in 1916. Following graduation he became research engineer, Detroit Edison Co., and in 1918 served as research metallurgist, bureau of aircraft production. The following year he became connected with the Aluminum Co. of America, as research chemist, and in 1931 joined the A. O. Smith Corp., Milwaukee, as director of metallurgy. He was appointed chief metallurgist of the Chicago district, Republic Steel Corp. in 1934.

G. A. WEBB and A.L. KERSHAW have been made district representatives in the Detroit-Toledo district for the Despatch Oven Co., Minneapolis. The Detroit address is 337 Curtis building.

J. S. VANICK, development and research department, International Nickel Co. Inc., New York, recently addressed the Toledo chapter of the American Society for Metals on "Short Sketches of Recent Progress in Cast Iron."

GEORGE SCHULTZ has resigned as superintendent of the Apex Steel & Iron Foundry, Maywood, Calif. Mr. Schultz received his training in the shipyard foundry of the Bethlehem Steel Co., and originally went to California to manage the United Casting Co., Los Angeles.

EDGAR A. PETERSON has been placed in charge of the foundry division, Dodge main plant, Chrysler Corp., Detroit. Mr. Peterson was born in Hamburg, Germany, in 1895, and was graduated from public schools in 1909. He served his apprenticeship in the Blow & Vos Ship Building Co., and then was made assistant engineer on the Hamburg-American line. In 1921 he started work at Dodge Brothers as a toolmaker. His ability as an all around mechanic was quickly recognized and he was transferred to the master mechanic's staff. In 1930 he was assigned to the foundry division as superintendent.

M. S. METZGER has been appointed supervisor of the central pattern department, Dodge main plant, Chrysler Corp., Detroit.

PLUMB TAYLOR BANCROFT, foundry superintendent, John Deere Harvester Works, East Moline, Ill., recently was voted a life membership in the American Foundrymen's association by the board of directors. Presentation was made at the Oct. 21 meeting of the Quad-City group by John Ploehn, French & Hecht, Davenport, Iowa. For many years Mr. Bancroft has contributed to the work of the Quad-City association as well as the American Foundrymen's association. He has been a regular attendant at A.F.A. conventions and usually has assisted in the presentation of one or more programs. For several years he was chairman of the committee on shop operations courses, and again has accepted that responsibility for the 1936 convention. In his foundry career, Mr. Bancroft has helped greatly in building the foundry with which he is connected from a small shop to one of the most up-to-date plants in the Quad-City area.

D. A. CURRIE, for the past 12 years vice president and general manager, Erie Foundry Co., Erie, Pa., recently was made president and general manager. Mr. Currie has been associated with the Erie plant for 29 years, begin-

R. S. Archer

E. A. Peterson

D. A. Currie

ning his career as timekeeper in the year 1906.

W. C. MacFarlane, president, Minneapolis-Moline Power Implement Co., Minneapolis, was elected president of the Farm Equipment institute at a recent meeting in Chicago. C. R. Messinger, Oliver Farm Equipment Co., Chicago, was elected executive chairman, F. H. Clausen, Van Brunt Mfg. Co., Horicon, Wis., first vice president; Robert A. Jones, secretary.

Lloyd D. Brady recently was made general superintendent, Ferro Machine & Foundry Co., Cleveland. For the

L. D. Brady

past 3 years Mr. Brady has been connected with European foundries, spending 2½ years in France and 6 months in Italy. Previous to that he was connected for a number of years with the Rouge foundry of the Ford Motor Co., Dearborn, Mich.

Robert L. Baldwin, has been made sales development manager, Electrode division, National Carbon Co., Niagara Falls, N. Y. Mr. Baldwin has been associated closely with electrode and electric furnace industries for 25 years. After spending several years with United States Steel Corp., he was sales manager of the Republic Carbon Co. for 15 years, and recently was sales manager, Republic division, National Carbon Co.

Robert L. Baldwin has been made technical staff of the International Nickel Co. Inc., New York. Mr. Beasley's metallurgical experience has been gained with the Delco-Remy division of General Motors, the Estate Stove Co., and the Centre Foundry & Machine Co. In addition, he has carried on research into steel pouring practice at Mellon Institute of Industrial Research, Pittsburgh, and was research fellow at the United States bureau of mines, Washington, where he was concerned with the physical chemistry of steel making.

Lowell O. Stewart has been appointed personnel officer for the division of engineering, Iowa State college, Ames, Iowa, and will supervise all the personnel work in that division. Prof. Stewart recently has been associate professor of civil engineering and one of the junior college counselors on the personnel staff.

He received the degree of bachelor of science in civil engineering from Michigan State college in 1917, his master of science degree from Iowa State college in 1927, and his professional degree in 1928.

William M. Black recently was elected vice president in charge of sales, American Manganese Steel Co., Chicago Heights, Ill. Mr. Black first entered the employ of that company in 1912 when he undertook a training course in the Chicago Heights foundry, which extended over several years. Later he entered the sales department and after a short time was placed in charge of the Pittsburgh office. In 1927 he became eastern sales manager at New York and in 1934 was appointed general sales manager at Chicago Heights.

Lloyd R. Jackson, formerly assistant research supervisor, Jones & Laughlin Steel Co., has joined the staff of the Battelle Memorial institute in the di-Battelle Memorial institute, Columbus, O., in the division of general metallurgy.

Robert E. Parkinson, formerly connected with the Inland Steel Co., has joined Battelle in the division of physical metallurgy. M. L. Samuels, formerly metallurgist,, Tennessee Coal Iron and Railroad Co., and J. G. Lowther, formerly research fellow, University of Illinois, also have become connected with that division.

Dr. W. C. Ashley, formerly with the Eastman Kodak Co., has become connected with Battelle in the division of applied chemistry.

Dr. C. F. Schmarje, formerly research assistant of Iowa State college, now is connected with the fuels division.

St. Louis Founders Form Chapter of A. F. A.

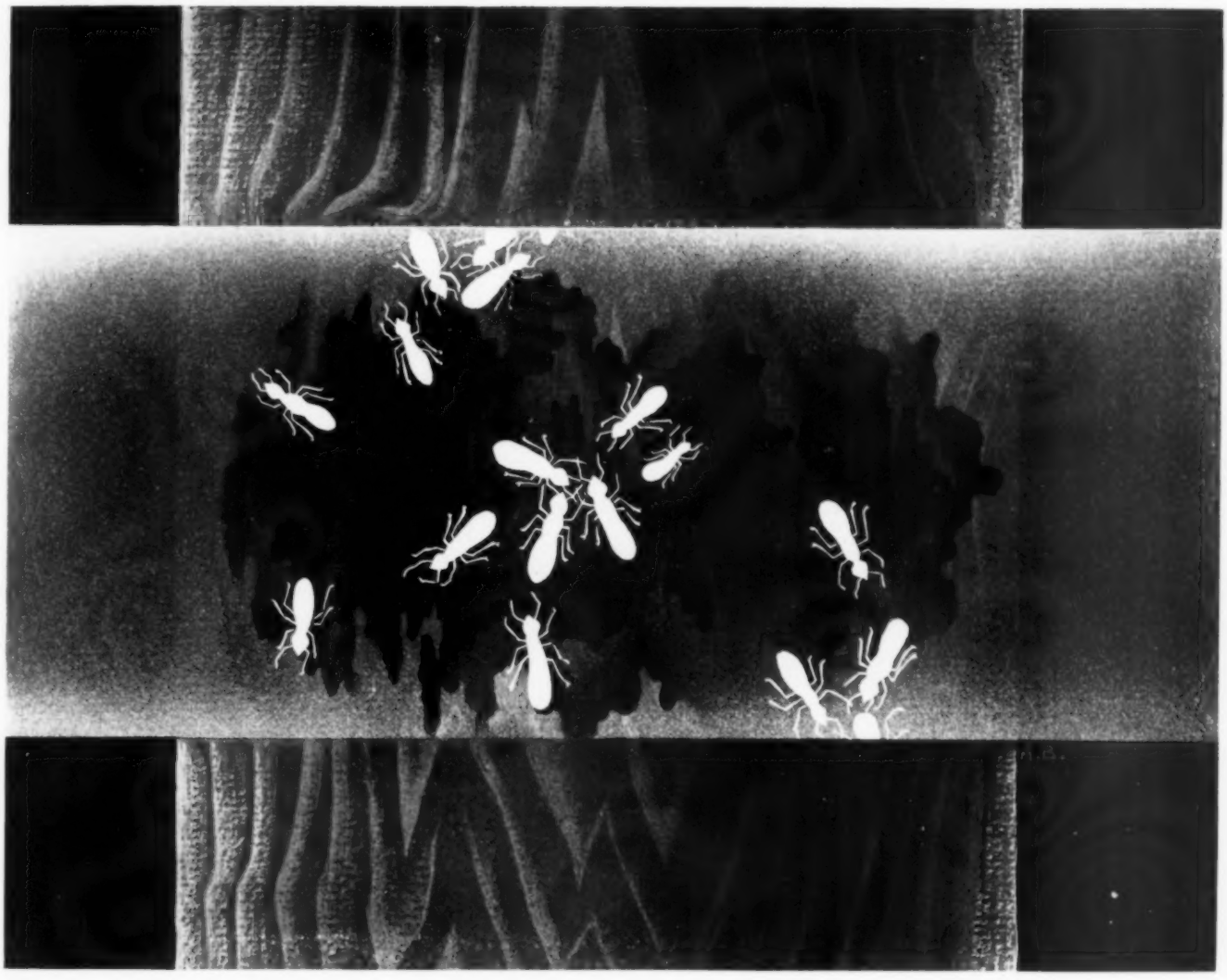
St. Louis District Foundrymen's club voted on Oct. 10 to petition the American Foundrymen's association for a chapter of the A.F.A. It was voted that the following officers of the club would continue as officers of the St. Louis chapter: Chairman, T. C. Hamlin, U. S. Radiator Corp.; vice chairman, R. Jacobsen, Carondelet Foundry Co.; and secretary-treasurer, E. A. Goerger, City Pattern & Model Co. Directors are as follows: C. R. Culling, Carondelet Foundry Co.; G. W. Mitsch, American Car & Foundry Co.; M. A. Bell, M. A. Bell Co.; F. T. O'Hare, Central Brass & Aluminum Co.; Webb L.

William M. Black

Kammerer, Midvale Mining & Mfg. Co.; Louis J. Desparois, Hickman, Williams Co., and H. Goodwin, Medart Co.

H. Bornstein, Deere & Co., Moline, Ill., presented the feature address of the evening on "Heat Treatment of Cast Irons." The speaker discussed the metallurgical and shop processes involved, first outlining the various purposes of heat treatment. He next showed the properties which might be obtained from heat treatment of ordinary gray iron and alloyed gray iron and illustrated with slides numerous examples of castings which had been heat treated. Charts containing the physical data of the castings were presented.

Postures of operators' arms and other body parts, whether in standing or sitting positions, should receive particular attention on the part of time study men, according to Dean F. W. Shumard of the National School of Time Study, Norwalk, Conn.



Invisible destroyers

TERMITES work stealthily — in the dark. That they may be unobserved and unmolested, their attacks on, say, a wooden support are confined to its interior. Left standing is a thin outer shell. . . . And, often, not until things collapse is the slow, insidious destruction brought to light.

Among the "termites" that lurk in the very foundations of many industrial organizations are such invisible forces of reaction as "standard practices," "established methods," "acceptable formulæ" and "satisfactory materials." Unmindful of their portent, a business may move along complacently — until, suddenly, it finds that an alert competition has captured the market because it discovered means of decidedly improving the quality of its product and reducing the manufacturing cost as well.

Steel tools, implements, appliances, vehicles, engines, machines — or parts thereof, such as gears, shafts, bearings, springs, wheels, housings, frames, bodies . . . does your organization make anything the salability of which you would like to help advance still further? There is scarcely an instance in which the addition of a relatively small percentage of Molybdenum will not improve any steel — whether plain or specifically characterized by one or more of the various other excellent steel-alloying elements in existence. Furthermore, the production economies "Moly" effects will usually alone more than absorb its cost.

To engineers, metallurgists and production executives we offer these interesting books: "Molybdenum in 1934" and "Molybdenum in Cast Iron — 1934 Supplement." Also ask us to mail you our periodical news-sheet, "The Moly Matrix." Be free, too, to enlist our Detroit experimental laboratory's help at any time. Climax Molybdenum Company, 500 Fifth Avenue, New York City.

MOLY

CLIMAX **Mo-lyb-den-um**

INDUSTRY'S MOST MODERN AND VERSATILE ALLOY

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Major Thought

TO THE EDITORS:

It was nice of you to call my attention to your editorial appearing in the October issue of THE FOUNDRY.

As you know, I have entertained ideas of this kind for a long while and agree with everything said in this article. In fact, if it is possible to do so, I would like to get approximately 100 reprints of this page. I will take the liberty, if agreeable to you, of mailing these with a personal letter of my own to the editors of several magazines, secretaries of different associations, and personal friends of mine.

In fact, I am very anxious to do this because I am convinced that it is one of the major thoughts that we ought to get developed in this country for stabilization of good business.

Thank you again for the many courtesies you have shown me in the past.

A. C. DENISON
President

Fulton Foundry & Machine Co. Inc.
Cleveland

Buyer To Blame?

TO THE EDITORS:

The copy of your October editorial, "Sellers Need A Breathing Spell," was no doubt sent to secure my reaction, and here it is.

I am surprised to see a Penton publication dig out the old "Blame the buyer" slogan, and believe it is a serious mistake.

Does your editorial offer any constructive solution to the problems of your industry? Does it offer any leadership, guidance or practical help to anyone in or out of your industry? Or is it merely a space filler selected from the "Profitless pros,perity" file of several years ago?

Do you claim that members of your industry permit buyers to determine their prices and selling policies; or do others in the industry fix the limitations within which a member may exercise his discretion?

Do captive foundries have anything to do with it, or stampings, or plastics or forgings or low-cost efficiently operated plants?

Surely you don't advocate a buying policy that would offer to pay a profitable price to everyone seeking business.

Under the codes, we began with regulations that prohibited any sales below cost. How long did they last, and did buyers have any influence on the change to "Except to meet competition"? No, the absolute prohibition of sales below cost would have eliminated all the fair-weather producers in quick order.

Just when the Brooking institution announces the result of its studies of this depression, and finds the basic cause to be our refusal to permit increased efficiency and mechanization to be reflected in lower prices and increased production, your editorial is discouraging to those who expect leadership and constructive recommendations from our business publications.

G. A. RENARD
Executive Secretary-Treasurer
National Association of Purchasing Agents
New York

P.S. Your editorial on "Reciprocity" is just as shallow. Reciprocity ordinarily, is a sales tool, not a buying policy. The codes that standardized prices and practices left the small producers helpless when a large competitor wanted the business. When the little fellow gives up his flexibility, what does he have left to offer?

G.A.R.

First Steel

TO THE EDITORS:

Reference in a recent issue of THE FOUNDRY to the early days of the steel foundry industry in Chicago reminded me that I started to serve my time in a shop in South Chicago where the owner was making steel castings by the converter process in the late eighties. Some of the castings were fairly satisfactory, but many were about as solid and homogenous as a ½-inch riddle. I left this shop about 1888 and worked for about 4 years in various iron foundries in the Chicago district. Then I went to work in the iron foundry of the Illinois Steel Co., South Chicago.

One day about 4 years later an order was issued to try steel instead of iron in a certain casting that was not standing up in service. Since I was the only molder in the shop with any former steel experience, the superintendent elected me for the job. I admitted that I had worked in a steel foundry, but I did not profess to be an expert. For example I knew nothing of the sand mixture. This was regarded as a very important secret, known only to the man who prepared the facing sand in a locked room. No person except the mixer was allowed in this room. The molders received their supply of facing sand through a pigeon hole in the wall.

On various occasions I had tried to wheedle the information out of the sand man. Outside working hours I had tried filling him with beer, usually a sovereign remedy for the tongue tied. All hospitality was wasted on the ungrateful creature. Unlike a sponge, he could be filled to saturation, but nothing could be squeezed out of him. In a general way I knew that the mixture was made up of silica sand, clay and molasses water, but I knew nothing of the relative amounts of each. We made up a batch that conformed approximately to the required appearance, feel and smell. The mold was made, dried, taken over to the bessemer department, poured and then taken back to the foundry and shaken out. The casting was satisfactory in every respect, the first made by the Illinois Steel Co., and the embryo or seed of what later developed into an extensive steel casting department.

CHARLES FORSBERG
Sault Ste. Marie, Ontario

Buoying Force

TO THE EDITORS:

In the Questions and Answers section of THE FOUNDRY for October, under a discussion on the feasibility of pot cores to float, I notice the following statement: "....a body immersed in liquid on all sides except the top is buoyed up by a greater force than a similar body completely surrounded, that is with the top also covered. The weight of the liquid on top counteracts, to some extent, the pressure on the bottom."

If I remember my high school physics correctly, this buoying force is supposed to be equal, by Archimedes' Law, to the weight of the liquid displaced by it and, therefore, be independent of the depth of submergence of the body. The reason for this being due to the fact that with every increase in the weight of the liquid pressing on the top of the body, the corresponding upward pressure on the body is increased by the same increment; thus the buoying force, being the algebraic sum of the two, remains constant. Of course, this excludes the case when the body is submerged to an exceedingly great depth, sufficient to increase the density of the liquid: here, in my opinion, the buoying force will be increased due to an increase in the weight of the displaced by the body liquid, provided the body itself was not compressed. However, since the compressibility coefficient of liquids is generally small, this increase would be of slight magnitude.

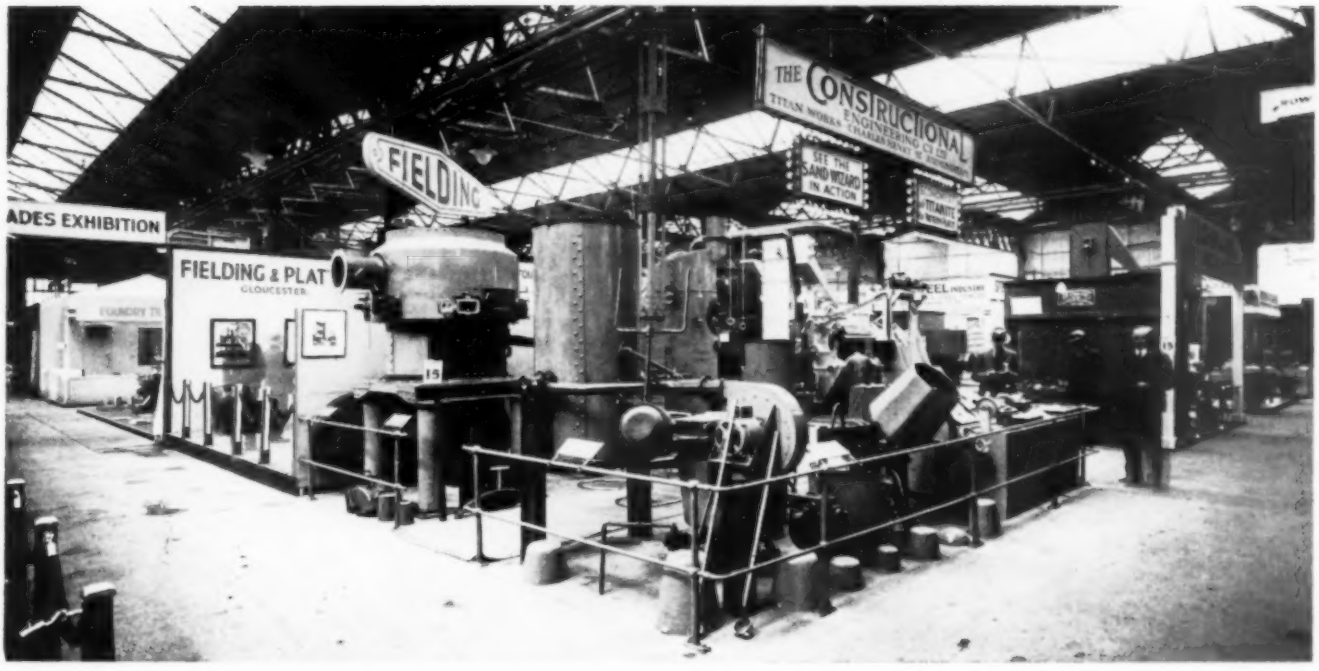
Although from the standpoint of a practical foundryman this discussion might appear of little interest, I should like to clarify this matter for the sake of "amica veritas".

D. NICONOFF
Clarkdale, Ariz.

Office Is Moved

Philadelphia office of the American Monorail Co., has been moved from 3312 Lancaster to the corner of Arch and Thirty-third streets.

ADVERTISING PAGES REMOVED



A wide variety of equipment featured the foundry section of the Shipping, Engineering & Machinery Exhibition

Exhibit Equipment in England

AN EXHIBITION of foundry equipment and accessories was held at Olympia, London, from Sept. 12 to 28 in conjunction with the Shipping, Engineering and Machinery Exhibition, which is held every 2 years. Foundry plant and equipment constituted the most important exhibits of the foundry section.

Coleman Foundry Equipment Co. Ltd., 156, Strand, London, W.C.2, showed a split pattern molding machine and split pattern jar ram power squeeze molding machine, both of which have open ends and adjustable sides to take flasks of all sizes and types. Other equipment included a sand throwing, disintegrating, aerating, purifying, revivifying, filling and mixing machine, a vibratory sand sifting machine, and three sizes of a core-blowing machine.

Sterling Foundry Specialties Ltd., Sterling Works, London road, Bedford, showed a comprehensive selection of rolled steel molding flasks of various types and sizes. The range of sections originally used has been extended greatly, and sections are now available which permit of the construction of flasks up to 10 feet x 20 feet and 2 feet deep or deeper.

Tilghman's Patent Sand Blast Co. Ltd., Broadheath, Near Manchester, exhibited a model of the Wheelabrator, for which the firm has the sole right of manufacture and sale throughout the British Empire, except Canada. In addition to this exhibit there were several types of sand and shot blast machinery, a 30 x 36-inch tumbling barrel, and a range of air compressors.

Constructional Engineering Co. Ltd., Titan Works, Charles Henry street, Birmingham, 12, showed a wide range of foundry equipment, including a bottom section of the cupola of the latest design with a capacity of 4 to 5 tons per hour. A feature of this display was a machine which blasts castings without the use of compressed air.

Shows Sand Mixer

August's Ltd., King Cross, Halifax, Yorkshire, showed an August's-Simpson sand mixer having a capacity of 30 tons per hour. On the sand were large-scale photographs of composite sand plants embodying that type of sand mixer. These sand plants are built in sizes covering outputs of from 2 to 15 tons per hour.

Rapid Magnetting Machine Co. Ltd., Magnet Works, Lombard street, Birmingham, 12, had a comprehensive range of various types of magnetic separators, scrap-sorting magnets, lifting magnets, chucks, and clutches. A drum-type machine was shown in operation. A type "V" electro-magnetic separator of the oscillating chute pattern also was operated. In this machine the magnetic units and electrical windings remain stationary, being supported on a fabricated angle section framework.

Fordath Engineering Co. Ltd., Hamblet Works, West Bromwich, Staffordshire, showed a core sand mixer and its multiple rotary core machine. There was also a new type of cutting-off device for cutting cores to standard lengths rapidly.

Electromagnets Ltd., 2, Church street, Colmore Row, Birmingham, 3, displayed, in addition to a range of lifting magnets, some magnetic separators, one being a rotary drum separator and another a jig shaker machine for dealing with powders.

Consolidated Pneumatic Tool Co. Ltd. Egyptian house, 170, Piccadilly, London, W.1, exhibited portable pneumatic hammers and rammers. An electrically-driven air compressor was installed and controlled by an automatic starter and cut-off switch. There were also grinding, sanding and polishing tools.

The special furnace section was limited to two stands. William Cumming & Co. Ltd., Kelvinvale Mills, Maryhill, Glasgow, Scotland, showed a recently developed coke fired furnace which is able to melt up to 500 pounds. It is suitable for melting brass, aluminum, alloys, iron, etc. and consists essentially of cylindrical steel shell, lined with refractory material. The blast, in addition to passing through the fire-grate, also feeds a number of spirally-disposed tuyeres. The furnace cover is mounted

on wheels, so that it easily can be pushed in and out of position. The cover is perforated by an 8-inch circular hole, so that small additions to the crucible can be made without removing it.

Morgan Crucible Co. Ltd., Battersea Works, Church road, London, S.W. 11, exhibited two types of furnaces, one for alloy cast iron and the other for aluminum alloys. The furnace for alloy cast iron, which can also be used for refining purposes, has been developed from the original type made by the manufacturers in the past 2 years. These furnaces are made in sizes up to 600 pounds iron capacity: they can be tilted so that the molten metal is poured through a hole in the top cover, and are so built that the flame cannot come into contact with the charge. These furnaces are oil-fired. On the same stand were displayed a wide range of the various crucibles and retorts.

Strong Core Binder

A wide range of blackings, core oils and foundry requisites were shown by: Thomas Wilkinson & Co. Ltd., Stockton street, Middlesbrough, Yorkshire; British Foundry Units Ltd., Retort Works, Chesterfield; Wm. Cumming & Co. Ltd., Kelvinvale Mills, Maryhill, Glasgow, Scotland, who exhibited a core made with a new semiliquid core binder, a section of which core was 1-inch square and for a number of days had held an 84-pound weight without breaking; and Spermolin, Ltd., Union street south, Halifax, Yorkshire. The latter firm also displayed a sand-mixing machine with locking device which makes it impossible to start the machine until the safety grid is in the closed position. The firm also showed a core extruding machine which produces round cores of any diameter from $\frac{3}{8}$-inch to 3 inches. This machine has a rising and falling tray carrier which adjusts the tray to the exact level of and parallel to, the die, thus obviating the necessity of packing up the tray and eliminating bent and distorted cores.

Scientific instruments were displayed by Charles Hearson & Co. Ltd., 27, Mortimer street, London, W. 1. The principal items were the universal camera microscope "M.e.F."—a combined bench instrument adapted for direct observation and photomicrography and under all kinds of illumination in transmitted and reflected light—and a large metallurgical microscope "M.e.A.", which is an advanced design of the E.M.I. (Le Chateriel Type).

Imperial Chemical Industries Ltd., Millbank, London, S.W. 1, had a display describing and explaining the sodium carbonate process for the treatment of metals. Samples of sodium carbonate in the forms used in the foundry were shown, and many types of castings, both ferrous and nonferrous, treated with sodium carbonate were exhibited. Atlas Preservative Co. Ltd., Fraser Road, Erith, Kent, showed samples of various compounds.

International Meehanite Metal Co. Ltd., 14-20, Church street, London, N. 1., displayed castings in Meehanite metal, produced in Great Britain by a number of licensees of the process. Among the exhibits were camshafts and crankshafts of heat-treated Meehanite, dies cast to a file finish and for which no machining is necessary, cylinder liners, gears, pump parts, brake drums, rock crushers, cement mixers, etc. Various test-pieces also were shown, indicating that the quality of the metal was the same throughout the thickness of the casting.

In the raw materials section, various brands of pig iron were displayed on the stands of: United Steel Companies Ltd., 17, Westbourne road, Sheffield, 10; Thos. W. Ward Ltd., Albion Works, Sheffield, who also had a display of coke, molding sand, limestone, and core oils; Colville's Ltd., 195, West George street, Glasgow, Scotland; William Baird & Co. Ltd., 168, West George street, Glasgow, Scotland; Ford Motor Co. Ltd., Dagenham, Essex, who exhibited groups of representative castings made from Ford pig iron and a cast steel crankshaft driven by the air from a household fan; Bradley & Foster Ltd., Darlaston, Staffordshire, who displayed examples of their refined alloy pig irons containing chromium, nickel, copper, molybdenum, tungsten, and also nickel copper chrome iron as used for the manufacture of austenitic irons.

Refined Pig Iron

Sir W. G. Armstrong, Whitworth & Co. (Ironfounders) Ltd., Close Works, Gateshead-on-Tyne, Durham, showed examples of their New Process pig iron, refined in a powdered-fuel type of rotary furnace, and also exhibited a heat-treated roll made of an alloy iron. Stewarts & Lloyds Ltd., 41, Oswald street, Glasgow, Scotland, showed examples of their various grades of pig iron, ironstone, limestone, slag, etc. British Pigirons, Ltd., Abbey House, 2, Victoria street, London, S.W. 1, also displayed representative examples of their special pig irons, together with fractures, test-pieces, micrographs, etc.

A complete range of nonferrous alloys in notched bars, ingots, extrusion billets, wire bars, etc., was exhibited by T. J. Priestman Ltd., Cupro Foundry, 94, Leopold street, Birmingham, 12.

In the refractories section the various types of refractories available to the foundry industry were shown by English Clays Lovering Pochin & Co. Ltd., St. Austell, Cornwall; General Refractories Ltd., Wicker Arches, Sheffield, and the Carborundum Co. Ltd., Trafford park, Manchester. J. Parish & Co., Erith, Kent, displayed samples of sand.

Handbook Gives Information on Wood

A wood handbook containing basic information on wood as a material of construction, with data for its use in design and specifications, recently has been published by the United States department of agriculture, Forest service. The publication, containing 326 pages, covers structure of wood, characteristics of some important commercial woods, physical properties of wood, strength values of clear wood and related factors, grades and sizes of lumber, structural timbers, timber fastenings, wood beams, columns and arches, glued wood construction, etc.

The publication may be secured from the superintendent of documents, Washington, for 25 cents.

PUMP CASTINGS – *an Opportunity for Increased Business...when made of*

NICKEL
CAST IRON

● This big centrifugal handled over 7,000,000 cu. yds. of abrasive sand, clay and silt in 19 months, at which time its Nickel iron shell showed only negligible wear. Shell cast by Nordberg Mfg. Co. (Milwaukee).

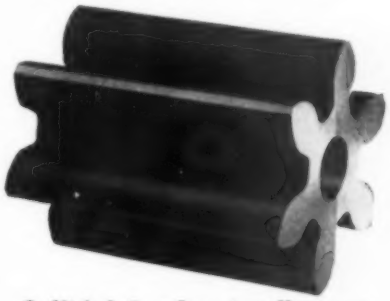
● Foundries are becoming increasingly alert to the profitable, new business awaiting them from pump manufacturers.

But pump makers today are demanding greatly improved properties in their iron castings ...properties that can be readily obtained by alloying with Nickel.

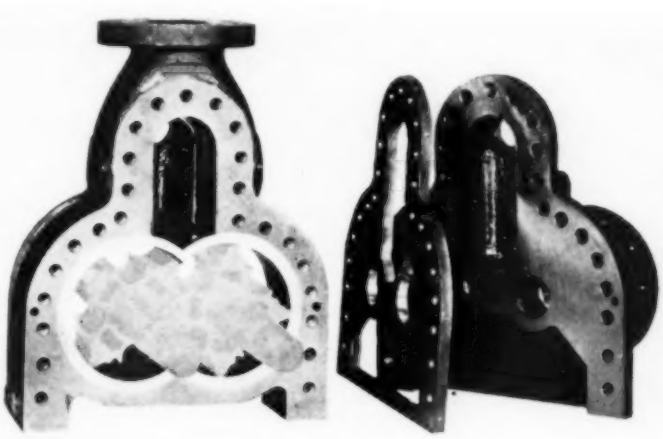
Foundries that are using Nickel find that it produces castings of high strength, toughness, density and uniform structure, for pressure tightness, easy machinability and stubborn resistance to hard wear, abrasion and corrosion.

Our engineers are always glad to cooperate with foundries in advising application, composition and best foundry practise. Write us freely.

● Nickel Cast Iron impeller used in pumps handling slurry and sludge. Manufactured by Morris Machine Co., Baldwinsville, N. Y.



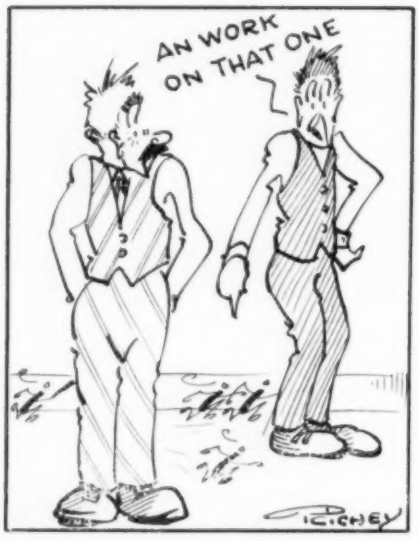
● Nickel Cast Iron impeller gear for Deming Rotary Pump. Contains 1% Nickel and 0.50% chromium.



● Pump-body, gasket and end plate of Nickel Cast Iron containing upwards of 3% Nickel and 2% chromium (depending upon size and type). Produced by Midway Foundry Co., St. Paul, Minn. for Northern Pump Co., Minneapolis, Minn.

NICKEL
CAST IRONS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.



The tempter struts his stuff

The Adventures of BILL

By PAT DWYER

HERE'S something," said Bill, "that will kind of test out the old reasoning ability. In reality it is ridiculously simple provided, mind you, provided you start off on the right foot. That is just a hint I am throwing out free gratis you might say. If you bear that in mind you might, I don't say you will, but you might ring the bell the first shot. Otherwise you may flounder around in the morass up to your armpits for a week without finding the answer. I ran across the thing the other night in an old magazine and it certainly is a honey. Maybe," suspiciously, "maybe you have seen it already, hey?"

"Incidents of that kind are not impossible," I admitted. "I learned to read many years ago and I dip into a magazine occasionally. However, in the present instance, notwithstanding your exceedingly clear and detailed presentation I fail to recognize this particular honey. If I may presume on old acquaintance and all that kind of thing, and if you are not violating any solemn vow, perhaps you might be persuaded to mention—say—one or two of the salient features. I am not a mind reader."

"All right. All right and the telephone number in New York is Murray Hill—excuse it pliz. I was thinking of two other fellows. Listen now carefully while I hand you the dope. Are you all set? Mind at concert pitch, every faculty alert, ears functioning accurately and memory honed to a razor edge?"

"You omitted straining at the leash, champing on the bit and rarin' to go. Just a brief reminder, Sir. Everything pulling alow and aloft and the lights burning bright, Sir!"

"You'll need 'em bright to wiggle your way through this one. A certain man going down the street met a girl and an elderly friend he had not seen for 20 years. Naturally they were greatly pleased to meet each other and the questions and answers flew back and forth. Almost the first question on each side was in regard to the marital status of the other. 'Oh, yes,' said the friend, 'I have been married for many years. This is my oldest girl. She is going on 16 and makes me realize that I am entering the ranks of the ancients.'

"'Well, well,' says the man, 'and so this is your daughter. What's your name, my dear?'

"The girl made him a neat little curtsy and then remarked archly: 'My name is the same as my mother's.'

"'Ah,' said the man, 'I only need one guess. Your name is Margaret.'

"There you are," said Bill complacently. "How did the bird know that the mother's name was Margaret?"

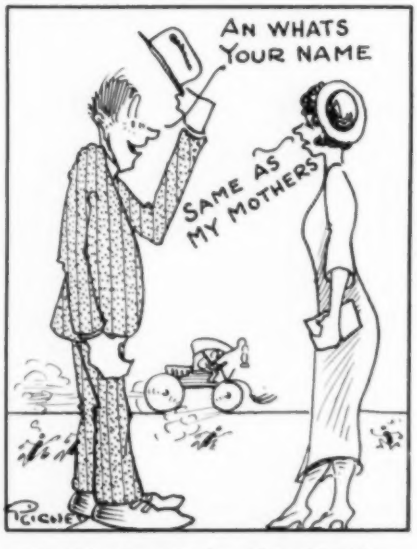
"Let's go over that again," I said. "I want to get it straightened out properly in my mind. A man meets an old crony he has not seen for 20 years. Did not know he was married and therefore of course did not know the wife. Yet when the daughter says her name is the same as her mother's he immediately says that her name is Margaret. Well, without giving the problem too much study, I should say off hand that he just took a stab in the dark, blurted out the first name that came into his mind and happened to hit the target after the manner of these fortunate individuals who win fabulous sums—sometimes—on a $2 bet at the races."

"I thought I'd hook you on that one," Bill said. "Simple as *ABC*, I even gave you a hint at the beginning, but you did not profit by it. The example is another illustration of the manner in which people jump to conclusions instead of calmly considering all the facts and statements from every angle. I did not say that the man met another *man*. I said the man met a friend. Manifestly a friend may be either a man or a woman. In this instance the friend was a woman he had known before her marriage. Naturally he knew her given name. Simple, hey?

"I wish all the problems were as simple as that one. I heard from a man recently who wanted some light on an annoying problem that pops up in the foundry every now and again, a problem for which up to the present I have not learned any really satisfactory answer.

"He wrote me that he was having trouble removing a long narrow core 1¼ x 4 x 33 inches which runs horizontally through a heavy casting. The core leaves a clean hole after it has been removed with a great deal of difficulty, but examination of the core fragments shows that the sand is saturated or heavily impregnated with iron. He sent me a hunk of the core and certainly it was heavier than sand. He also said that this form of trouble occurred only in semisteel castings containing about 50 per cent steel in the mixture.

"At one time or another I have seen this particular form of bugaboo pop up in a shop, but up to the present I never have found a satisfactory explanation. The iron apparently



A chippie off the olde blockke

soaks into the core after the manner of water soaking into a lump of sugar, but the puzzle is if the iron soaks into one core, why does it not soak into all cores?

"In some experiments I tried on cores in steel castings several years ago I found that large vent holes greatly facilitated the removal of the cores. I tried them on the theory that large vent openings not only would allow the gas to escape more freely, but that they would relieve the pressure and hence the material in the core raised to a high or fusing temperature would not be compressed so densely. One prominent foundryman tells me that he achieves the same result by mixing coal dust or sawdust with the sand. This combustible material burns out and as a result the core is fairly porous and easily removed.

"Experience of several foundrymen confronted with this annoying problem indicates that a dead, inert sand works more satisfactorily than new, sharp sand. Also that a fine sand is preferable to a sand with more open grains.

"A foundryman in this district uses a mixture of half and half new and old molding sand bonded with a minimum amount of dry binder. In addition, he incorporates a handfull or two of plumbago in the core sand mixture. After the core is dried he coats the surface heavily with a good grade of blacking. He does not favor large vents, first because he does not think they are necessary, and second because of the danger of the pressure forcing metal in the vents, or of causing the core to collapse slightly along the side in the vicinity of the vent passages.

"After many trials with practically every variety of sand a second foundryman has resorted to the expedient of covering the core with sheet asbestos. After the core is dried he pastes the paper in place and in some instances runs strands of wire around it.

"A third method is to use a steel pipe instead of a sand core. In some instances the empty pipe retains its shape, while in others it is necessary to pack the pipe full of sand. Spent or burned sand from the cleaning room is more satisfactory than any other. No binder is necessary.

"I have heard the subject debated but up to the present I have not heard a convincing argument. I knew a man one time who held to the theory that it is an inside job, that is a condition set up in the core itself and not a case of iron seeping in from the casting through the pores of the core. You may be convinced that the iron in some manner soaks into the core. Many men, probably the majority, hold to the same opinion. However, as a thoughtful foundryman who wants to consider the proposition from every angle you may be interested in some of the reasons on which he based a conclusion at variance with that generally held.

"The first is that the hole is clean after the core is removed. To his mind that indicates that the metal—as usual—formed a skin or sheath around the core almost immediately, and that this skin constantly grew thicker as the metal cooled and solidified. This thick or comparatively thick metal would not seep into the sand like water into a lump of sugar. If it had seeped in, the inside surface of the hole would be rough and ragged with small and large projections all over it.

"Let us now consider the core, its composition and the chemical and physical changes which take place at high temperature and while it is subjected to considerable pressure. In the ordinary core in an ordinary casting only the outside is raised rapidly to the temperature of the surrounding metal. By the time the entire core has been raised to the maximum temperature throughout, the temperature of the metal has fallen to a considerable extent and as a result the entire core never attains the original temperature of the metal.

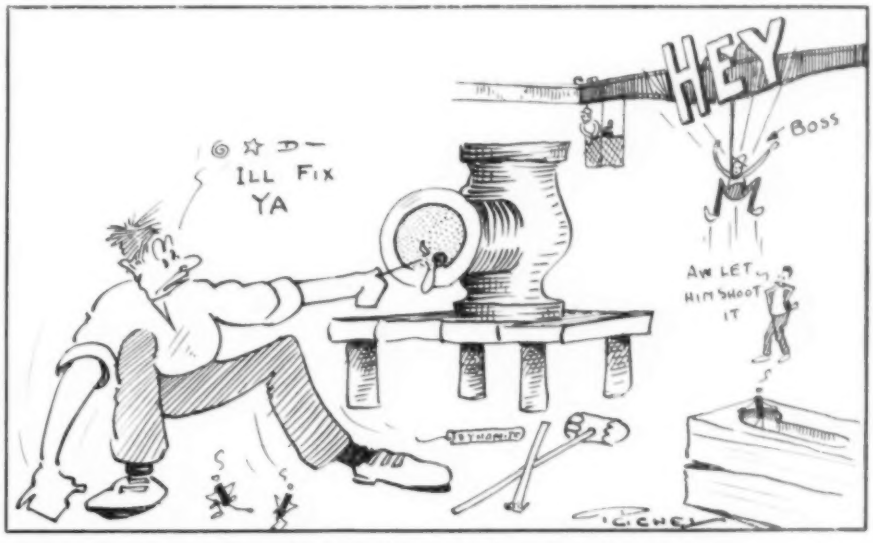
"In the particular case under consideration, a small core and a thick body of metal, the entire core is raised to the temperature of molten metal and—mark this—it is held at that temperature for some time. At high temperature the silica grains or quartz grains change their formation which results in expansion, and pack more tightly together. This condition is accentuated later by the contraction of the casting. To some extent the action is comparable to that of any soft material in a press. It becomes denser. At this temperature also, any clay in the sand is bound to fuse, and of course later solidify, thus binding the grains of sand tightly together.

"Now we come to iron impregation throughout the core and deposited in small globules on the core rod. The theory advanced for this is that the sand contains a certain amount of iron oxide in its composition. Normally, this is not affected, but under the severe conditions obtaining in this particular core, the iron oxide unites with the carbon from the binder and becomes metallic iron. This would account for its universal distribution throughout the core as shown upon removal from the casting. To a certain extent the core is subjected to a coking or reducing process. It is raised to a high temperature, but the carbon from the binder is not burned or consumed rapidly enough. Hence a certain amount is free to combine with the iron oxide.

"One obvious remedy is to vent the core so thoroughly that all the gas can escape as rapidly as it is generated. This will prevent the formation of metallic iron in the core. The numerous vent openings will take up the expansion of the sand grains and thus reduce the density. In this particular core three ½-inch diameter vents would not be too many, or a greater number of smaller vents might serve more satisfactorily.

"The only trouble with that ingenious and elaborate theory," said Bill, "is that it falls flat in the face of the fact that hunks of the core coming out of the casting weigh a great deal more than similar pieces of the original core. That is sufficient evidence that in some manner the iron soaked in from the casting. Why don't you extend an invitation to foundrymen all over the country to forward their views on the subject?"

Well, here you are, boys. The meeting is now open.



Modern foundry cleaning technique: Blowing the core

Detroit Group Forms A. F. A. Chapter

The Detroit Foundrymen's association, at a meeting held Thursday evening, Oct. 17, voted to petition the American Foundrymen's association for a local chapter. The following officers of the Detroit group will continue as officers of the Detroit chapter of the A.F.A.: Chairman, Vaughan Reid, City Pattern Works, Detroit; vice chairman, Leslie G. Korte, Riley Stoker Corp., Detroit; secretary, Harry J. Deutsch, Aluminum Co. of America, Detroit; treasurer, Frank X. Mushynski, American Car & Foundry Co.

It was announced that committees for arranging details in connection with the 1936 convention and exhibition of the American Foundrymen's association, to be held in Detroit, the week of May 4, 1936, now are being appointed. Vaughan Reid will act as general chairman of the committees.

Dr. F. R. Hensel, metallurgist, P. R. Mallory & Co., Indianapolis, spoke on "Crystallization of Metals in Chill and Sand Castings."

Comments on Pig Iron Conference

The following interesting discussion by J. F. Froggett on certain phases of the pig iron situation recently appeared in *Daily Metal Trade*:

Pig iron producers and consumers held a heart-to-heart talk in Chicago recently during the fall meeting of the Institute of Metals division, Iron and Steel division, of the American Institute of Mining and Metallurgical Engineers. It took the form of a round-table discussion on "Qualities of Pig Iron," and the official referee was Ralph H. Sweetser. Not that it was a battle, but it was something more than mere tittle-tattle. Couldn't help but be just that, with pig iron occupying the position of the "puck." There was considerable shuffling back and forth, this being the first such meeting for exchange of ideas for years—seven, in fact, to be exact. When the confab ended, apparently the conferees had gotten nowhere very definitely; but the atmosphere had been cleared appreciably.

Immediate bone of contention was the question asked by the foundrymen present: "What is the matter with pig iron?" At which the furnace managers present went right back with: "What is the matter with the foundry's cupola mixers?" Which being a standoff, the discussion then veered around to the question: "Why do two pig irons of exactly the same chemical composition differ widely when they are melted and poured in the foundry?" All present admitted themselves puzzled and unable to reply, furnacemen as well as foundrymen. There appeared to be agreement that if any one knew absolutely just what took place inside the blast furnace while the ore is being smelted, then that man might be able to answer the question. Theories on what takes place inside the stack do not account for it. Finally, it was declared to be a matter of "castability." Maybe that will do as well as anything else to describe this property of just pig iron.

Projecting itself into the discussion, at first rather unobtrusively, came up the subject of the use of scrap in the foundry. More and more of late years is scrap entering into the raw material bins of the foundries, gray iron as well as steel. Cast iron scrap has taken a front seat in the scrap bandwagon, at least so far as pertains to foundry purchasing. Too, heavy melting steel also is shouldering aside a certain proportion of merchant pig iron, to the discomfiture of the furnacemen. Control of the cupola content is sought by the foundryman today, the old rule-of-thumb charging methods being discarded. Too, the foundrymen now have an ally in the blast furnace or electrically produced ferrous alloys.

Experts agree that they know of nothing that can be done to improve the product of the blast furnace at this time. There enters into this picture, control of pig iron's cooling, new modern practice being to use air instead of water at the pig casting machine. There then appears to be no chance for the pig to remain molten inside, but it cools uniformly across the entire section. This tends to affect the tensile strength, some say about 10 to 30 per cent increase. Then arose the question of grain structure of pig iron; and all admitted they could not explain the differences in grain structures and their control. Which brought up the matter of "free graphite" in pig iron. And, too, there injected itself into the round-table the question of furnace slags and how ultimate control of the characteristics of certain pig irons might be attained through slags. And, so, with the whole subject left just about right there, the round-table dissipated itself.

Michigan State Plans Sectional Meeting

A one-day section meeting, devoted to "High Temperature Melting of Cast Iron" will be held at Michigan State college, East Lansing, Mich., on Feb. 7. The meeting will be held under the auspices of the American Foundrymen's association, Michigan State college, and the Detroit chapter of the A.F.A.

Moves Office

Great Lakes Foundry Sand Co. has moved its general offices to 720 United Artists building, 154 Bagley avenue, Detroit.

Features Methods of Increasing Production

N. E. Vaughn, foundry superintendent, Florence Stove Co., Gardner, Mass., addressed the regular meeting of the New England Foundrymen's association held at the Engineers club, Boston, Oct. 9, on "Quantity Production of Castings". The speaker dwelt mainly on the effects of cleanliness and orderliness of work floors on production, mentioning one instance where production had been increased 50 per cent by attention to neat workmanship of the molder. He also attributed good equipment, methods of gating and ideas such as stacking of molds as causes for increased production of castings. He stressed the importance of effective planning of the work and discussed various types of incentives.

A. B. Root, Hunt-Spiller Mfg. Corp., Boston, chairman of a special committee of the New England Foundrymen's association on the study of silicosis, reported for that committee.

A. S. Wright, Hunt-Spiller Mfg. Corp., Boston, vice president of the association, presided.

Book Review

Straight Thinking, by William J. Reilly, 167 pages, published by Harper & Bros., New York, and supplied by THE FOUNDRY, Cleveland, for $1.75.

Interesting observations through years of experimenting, first among students, and then more extensively among business men, culminated recently in a series of meetings on "Straight Thinking in Business." These lectures have been expanded into this interesting book. The work has been divided into several sections, the first dealing with the reasons for faulty mental attitude and common mistakes in thinking.

In the second section, the author reduces thinking to four simple steps as follows: 1—An observation suggesting an unanswered question or problem; 2—The problem is defined and possible solution considered; 3—Controlled experiments are set up and observations made; 4—Conclusion is drawn based on the result of experimental and other observations.

The third section discusses the ways in which the senses can be trained to make the precise observations. The author then points to the absolute need of defining the real problem and, in considering the possible solution, suggests that it is essential to see all sides of the question in securing evidence for possible solution, and then outlines the method for drawing conclusions.

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Sand Features Meeting at Quad Cities

Quad-City chapter of the American Foundrymen's association met at the LeClaire hotel, Moline, Ill., Oct. 21, with A. E. Hageboeck, chairman, presiding. J. Morgan Johnson, secretary-treasurer, reported on the foremanship conferences to be held during the winter at which a wide variety of problems will be discussed.

Harry W. Dietert, U. S. Radiator Co., Detroit, spoke on "Sand Control" in foundries. The speaker used slides and charts to discuss numerous sand tests made in the foundry, including permeability, strength, fineness and mold hardness. Mr. Dietert discussed numerous foundry losses, and the knowledge necessary to produce satisfactory castings through the use of proper sand.

The contraction and expansion test of sand, one that is assuming greater importance constantly, was discussed by the speaker. An active discussion period followed the talk on sand.

The next meeting will be held at the Fort Armstrong hotel, Rock Island, Ill., Nov. 18. V. A. Crosby, Climax Molybdenum Co., Detroit, will talk on "Cupolas".

Foundries Awarded For Safety in Plants

National Safety council, at its annual congress recently held in Louisville, awarded 120 bronze plaques and 74 framed certificates to winners and runner-ups in seven major contests conducted by the council.

In the foundry division, the following four tied for first: Mackintosh-Hemphill Co., Midland, Pa., 339,385 hours, no injuries; American Rolling Mill Co., Central Works, Middletown, O., 181,809 hours, no injuries; Ideal Foundry & Machine Co., Beaver Falls, Pa., 153,577 hours, no injuries; the American Rolling Mill Co., Sixth street foundry, Ashland, Ky., 104,022 hours, no injuries.

A. S. M. E. Program Holds Foundry Interest

Several papers of interest to the foundry industry will be presented at the annual meeting of the American Society of Mechanical Engineers, to be held in the Engineering Societies building, New York, Dec. 2-6. These include: "Steel Plate Structures vs. Cast Iron" by R. T. Hazelton; "Influence of the Double Eddy Current on the Design of Dust Collectors" by H. von Tongeren; "Additional Responsibility Placed on Industry by Recent Occupational Disease Legislation," by H. D. Sayer; "Engineering Control of Occupational Disease Hazards" by Warren Cook; "Limitations of Protective Devices and Equipment" by Prof. Philip Drinker; "Present Status of Workers' Compensation Laws" by F. Robertson Jones, Frederick S. Kellogg and Austin J. Lilly.

Iowa Foundrymen Consider Sand Problems

The first fall meeting of the Northern Iowa Foundrymen's association, held at Cedar Falls, Iowa, Sept. 24, was devoted to a report of the recent Toronto convention of the American Foundrymen's association presented by J. C. Lund, foundry superintendent, John Deere Tractor Co., Waterloo, Iowa. Considerable interest was manifested in the discussion particularly in connection with the session dealing with health hazards and employer responsibility.

The second meeting was held in Waterloo, Iowa, on Oct. 22, with 75 in attendance. Harry W. Dietert, U. S. Radiator Corp., Detroit, presented an illustrated talk on "Sand Problems in the Foundry." Mr. Dietert was introduced by Horace A. Deane, Deere & Co., Moline, Ill.

Directors Dissolve Nonferrous Association

Nonferrous Foundry Association for Industrial Recovery, organized after the passage of the National Industrial Recovery act to form a code of trade practices for the nonferrous foundry industry and assist members of the industry in facing their trade problems, has been dissolved by action of the board of directors, according to an announcement by Sam Tour, executive secretary.

New Haven Firm To Handle Vibrators

Malleable Iron Fittings Co., Branford, Conn., has disposed of its interest in the manufacture of vibrators and other foundry equipment to the New Haven Vibrator Co., Stiles street, New Haven, Conn. George B. Pickop is president of the New Haven company.

Climax Molybdenum Co., 50 Fifth avenue, New York, has prepared a chart showing in ounces and pounds the amount of ferro molybdenum necessary to secure any desired percentage of molybdenum content in the resulting melt. The chart covers alloys ranging from 55 to 70 per cent content of molybdenum.

Cast Iron Plows Made for Many Years

By Fred B. Jacobs

Cast iron plows are particularly adapted to certain kinds of soils which, together wtih the fact that such plows can be produced economically, accounts for their widespread use, as evidenced by the fact that one prominent manufacturer has an annual capacity of over 1,000,000.

The cast iron plow is not an innovation as it is believed the first patent for such a device of which any record remains was granted to Robert Ransom, Ipswich, England in 1785 or 150 years ago. Some years later, in 1803, Mr. Ransom was granted another patent on a mode of chilling cast iron plow parts. Just what success Mr. Ransom achieved in building up a business in his plows is not known.

A cast iron plow is such a simple thing that it is difficult to understand why inventors devoted lifetimes to perfecting such implements only to fail and die in despair. Yet, such is the case. The first inventor to receive a patent on a cast iron plow in the United States was Charles Newbold of New Jersey. His patent granted in 1797 was signed by John Adams, then president of the United States. Mr. Newbold spent over $30,000 in perfecting his plow only to abandon the business later. Farmers at that time held some queer ideas. They didn't like cast iron plows. They preferred the wooden iron shod plow instead. They held the opinion that cast iron, pot metal they called it, poisoned the land.

In 1807 David Peacock of New Jersey obtained a patent on a cast iron plow which resembled Mr. Newbold's implement. It is a matter of record that Newbold sued Peacock for infringment and collected $1500. This was the first litigation over cast iron plows of which any record has been preserved.

Jethro Wood of New York was granted patents of a cast iron plow in 1814 and 1819. His plows were popular and by 1819 he was making over 3600 annually. However, he lost money on the venture. Later the New York state legislature recognized the value of Wood's efforts and awarded his heirs the sum of $2000.

About the year 1820 David Prouty, Hanover, Mass., was successful in making cast iron plows. He gradually succeeded in overcoming the popular prejudice against such implements and while his establishment was not a large one he did fairly well for that day. He made some 1000 plows annually and employed about ten men. He obtained a patent on a center draft plow which became quite popular later. The entire plow base was cast iron with a detachable plow point.

Castings Exhibited at Chicago

(*Concluded from page 29*)

manufacturers showed castings indicating the use or application of their products. Further, the American Society for Testing Materials in an exhibit of its committee activities showed some unusual die casting applications.

Prominent among the steel castings exhibitors was the Sivyer Steel Casting Co., Milwaukee, which used modern display methods and a unique application of mirror backgrounds to enhance the appearance of castings shown. These included machined and pressure castings, special alloy steels differentially hardened with the varying hardness clearly indicated. For instance in the flat sprocket shown near the center of the accompanying illustration, the teeth were hardened to approximately 350 brinell to obtain maximum wear resistance while the hub center was kept soft for machinability. Various types of heat treatment and compositions were shown and a large casting was exhibited upon which guesses were registered with a prize awarded.

Michigan Steel Casting Co., Detroit, showed a variety of products including centrifugally cast cylindrical parts. The Chicago Steel Foundry Co., Chicago, showed plain and alloy steel castings including a special heat resisting product and some exceedingly intricate conveyor screws of large size. This firm also had some beautiful art objects. In addition to a variety of castings including special heat and corrosion resisting and high manganese steel, the American Manganese Steel Co., Chicago Heights, Ill., showed welding rods and a number of enlarged pictures showing the method of examination by X-ray apparatus used in the research department.

Western Foundry Co., Chicago, displayed intricate light castings and examples of varied surface treatment including enameling. The Greenlee Foundry Co., Chicago, in addition to a regular line of gray iron castings displayed Meehanite products demonstrating the use of this special type of iron in wear, pressure and corrosion resisting service.

The Aurora Metal Co., Aurora, Ill., specializing in nonferrous casting showed examples of aluminum bronze die and sand castings for high strength light weight demands. The Stewart Die Casting Corp., Chicago, displayed aluminum, zinc and aluminum alloy die castings, many of unusual sizes and intricacy. Dow Chemical Co., Midland, Mich., offered an unusual variety of light, high strength, complicated castings of magnesium alloys.

Other firms which showed castings either of their own manufacture or using products which they produce included: American Brass Co., Waterbury, Conn.; Bethlehem Steel Co., Bethlehem, Pa.; Chapman Valve Mfg. Co., Indian Orchard, Mass.; Climax Molybdenum Co., New York; Dow Chemical Co., Midland, Mich.; Driver-Harris Co., Harrison, N. J.; Electro-Alloys Co., Elyria, O.; Electro Metallurgical Corp., New York; International Nickel Co. Inc., New York; Michiana Products Corp., Michigan City, Ind.; Molybdenum Corp. of America, Pittsburgh; New Jersey Zinc Co., New York; Titanium Alloy Mfg. Co., Niagara Falls, New York; Vanadium-Alloys Steel Co., Pittsburgh; and Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Chicago Chapter Hears Talk on Russia

Russia has encountered many problems in its attempts to develop its foundry industry and has met with indifferent success in the operation of new foundries built in that country, according to F. A. Jensen, Wm. H. Nicholls Co. Inc., Long Island, N. Y., who spoke before the Chicago chapter, American Foundrymen's association, Oct. 21 , on his 5 years' experiences in Russia.

Mr. Jensen served as foundry consultant and projecting engineer on various Russian foundry projects and also represented American equipment manufacturers abroad. Car wheel and steel foundries, in the design of which he was associated, were described. One of the principal difficulties Russian foundrymen face is the failure of their equipment, according to Mr. Jensen. Russia has attempted to build its own foundry equipment, patterning it after American design, but results have been unsatisfactory and failures of machines have been frequent. Only a small amount of equipment has been purchased in the United States.

Poor quality of native Russian sands, carelessness in selection of pig iron and lack of skilled men also have tended to retard the progress of the foundry industry in that country. Production of castings generally has been well below the capacities intended for the new plants.

The Chicago chapter has changed its meeting night to the third Monday of each month, the gatherings being held at the Medinah club. Nonferrous foundry practice will be the principal subject for discussion at the Nov. 18 meeting. Another lecture course is being offered by the Chicago chapter this year in addition to the regular monthly meetings. Similar lectures were given last year for the purpose of stimulating interest in the fundamentals of foundry processes and materials and in current foundry problems and developments. Six lectures will be given during the balance of the year, covering materials used in the foundry, with men prominently identified with the industry as speakers. The lectures are given at Lewis institute, 1951 West Madison street. N. F. Hindle, American Foundrymen's association, is secretary of the lecture course committee.

Northern Illinois Group Discusses Iron

The first fall meeting of the Northern Illinois Foundrymen's association was held at the Elks club, Rockford, Ill., on Oct. 8. R. H. Lee, Bethlehem Steel Co., Bethlehem, Pa., presented an interesting address on "Cupola and High Test Cast Iron." The speaker stated that he favored a high coke bed with high blast volume. The high bed is advantageous since it reduces the amount of iron melted in the oxidizing zone.

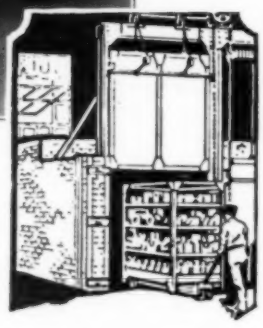
In discussing the high lime content in the charge, the opinion was expressed that the amount of lime is limited only by the ability to handle the slag. High slag volume assists in removing oxides and at high temperatures removes carbon and raises silicon.

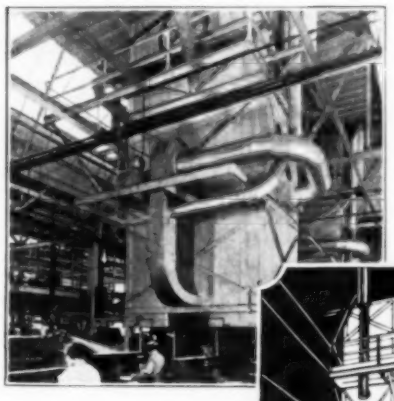
Mr. Lee stated that he prefers a limestone having 5 to 8 per cent silica and less than 20 per cent magnesia. Limestone of that silica content seems to be more active in removing sulphur than a limestone having a lower silica content. Iron melted under these conditions has a high temperature when tapped. It was brought out that high slag volume has the important property of effecting heat transfer.

Gates and Risers Featured at Pittsburgh

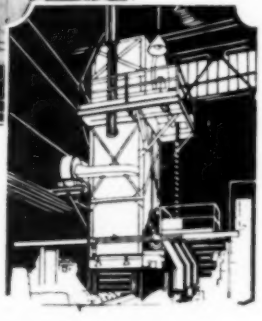
An interested group of 100 foundrymen listened to a lecture on "Gates and Risers," by Pat Dwyer, engineering editor of THE FOUNDRY, and discussed many points of foundry practice of special interest to members of the Pittsburgh Foundrymen's association at a meeting held Oct. 21. A. M. Ondreyco, Meehanite Metal Corp., Pittsburgh, presided at this, the first meeting of the 1935-1936 season. He introduced Dan M. Avey, editor of THE FOUNDRY, Cleveland, president, and James L. Wick Jr., president, Falcon Bronze Co., Youngstown, vice president of the American Foundrymen's association, who spoke on the work of that organization.

RACK TYPE OVENS

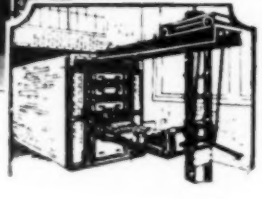




CONTINUOUS OVENS



ROLLING DRAWER OVENS



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CLEVELAND, OHIO

Produces Heavy Steel Castings

(*Continued from page* 26)

to that recently described in THE FOUNDRY.

Steel castings are annealed, and if necessary otherwise heat treated in large coal fired furnaces extending above and below the floor level. Access to the firing chamber is through the basement referred to previously. The roof of the furnace is made up of a number of brick lined arches which may be removed temporarily while the crane is placing the castings in the furnace.

Circular ingot molds fluted on the inside are employed for forming forging shafts of various sizes. Several distinctive features characterize this process designed to produce solid castings. The outstanding feature is a method of introducing the metal slowly to promote gradual solidification from the bottom to the top. The method also prevents the violent agitation of the metal which accompanies the ordinary method of pouring ingots where a full stream from the ladle nozzle is driven by the static pressure of the metal in the ladle.

The length of the shaft is governed by a sleeve which may be adjusted at the desired height by short rods inserted in holes in the sleeve and resting on the top of the ingot mold. A loam lined pouring basin is placed on top of the sleeve. A small opening in the bottom of the pouring basin admits the metal to the mold gently and at a speed designed to prevent cold shuts, while the metal is filling the mold as slowly as may be practicable. Through theory and actual operating experience a table of sizes for these openings has been established to suit shafts of varying lengths and diameters.

Pour Metal Slowly

In preparing the ladle to pour these shafts the smallest available nozzle brick 1½-inches diameter opening is fitted in the bottom of the ladle. By alternately lifting and lowering the stopper the operator keeps the pouring basin on top of the mold filled while the metal flows gently through the small opening in the bottom of the basin. In this manner the force and speed of the metal leaving the ladle nozzle is neutralized. The method presents a practical vindication of the theory advanced at various times by prominent foundrymen that castings should be poured in a manner to promote gradual solidification from the bottom upward, that the last and hottest metal from the ladle should enter the top of the casting, and that the factor of gravity plays an important part in feeding a casting.

Incidentally the foregoing factors are introduced in the production of many large castings molded in sand, where for any one of various reasons it is not practical to pour the metal directly into the top. Pouring ceases when the metal appears in the bottom of the risers. The ladle then is shifted and the remainder of the space in the riser openings is filled with fresh, hot metal.

On large steel ring castings individual risers are dispensed with. The thickness of the ring is increased a short distance above the casting proper, and the enlarged section is carried to a suitable height to serve as a continuous feeder. The superfluous metal later is cut off in the machining operation. On a typical large blank gear 17 feet diameter, 4 foot face, 5 inches thickness of metal cast recently, the thickness of the rim was increased to 7 inches and carried to a height of 30 inches above the casting. Combined heats from three open hearth furnaces amounting to 220,000 pounds were required to pour this casting. The outside of the mold was swept, finished and dried in a pit in the floor. The interior of the mold, arms and hub were formed in dry sand cores.

Practical limitations set up by the material in sand molds, also the wide area to be covered in certain castings where the metal thickness may not exceed a few inches, do not permit the employment of the slow pouring

(*Concluded on page* 62)

Fig. 11—General view of the main bay of the foundry with the furnaces in the bay at the right. Core room, drying ovens and roll molding department are in the bay at the left

Shrewd Buying Dictates a . . .

BARTLETT SNOW "Froth-Flotation" AIR FILTER

● Consider for a moment the experience of the large mid-western foundry—that installed a Bartlett-Snow "Froth-Flotation" Air Filter—then ran exhaustive tests—and replaced, based on these findings, two less efficient filters with Bartlett-Snow machines. They offer—

1. **NEW DESIGN**—Dust-laden air is drawn to a distributing chamber and water sprayed to remove the larger dust particles—then passed upward through bubble caps and a frothing filter carpet that traps the fines before the air is discharged.
2. **FIREPROOF CONSTRUCTION**—All steel construction and the entire absence of inflammable materials enable Bartlett-Snow filters to handle cold or hot air, with high efficiency and absolute safety.
3. **LOW OPERATING COSTS**—No manual supervision is required. There are no moving parts. From 50 to 75 cents worth of the "frothing agent" a day is sufficient for the operation of a 10,000 cu. ft. machine.
4. **LOW MAINTENANCE**—Absence of moving parts reduces maintenance to a minimum. There is no shaking or replacement of filtering units . . . No fires to put out. Infrequent inspection insures satisfactory operation.
5. **CONVENIENT LOCATION**—Machines need not be readily accessible. They can be erected on the floor—suspended from the roof to save floor space—or mounted outside the building.
6. **CAPACITY**—To meet any requirement. Standard units to 30,000 cu. ft. Multiple and two-pass installations if required.
7. **EFFICIENCY**—In actual operation 99.80%—purer than Ivory Soap. Passage—less than .015 grains per cu. ft.

The Bartlett-Snow is the one "right" filter for foundry work—moderately priced—proven in service—efficient in operation—and low in maintenance. Prices and more complete details are available on request. Write for descriptive literature.

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SHAKEOUTS • SCREENS • ELEVATORS • CONVEYORS • HOPPERS • MIXERS • AIR FILTERS
PARTIAL AND COMPLETE SAND PREPARATION AND SAND DISTRIBUTING SYSTEMS

Fig. 12—Typical view on one floor of the pattern shop with pattern for roll housing at left

(*Concluded from page 60*)

method, ideally suited though it is to the production of heavy, uniform section castings in iron molds. The steel ladles are fitted with double nozzles and in that manner the steel in the ladle is admitted to the mold in half the time that would be required if the entire amount had to flow through a single nozzle. In some instances two and in extreme cases, three ladles are required to pour a single casting.

A battery of large coke fired ovens occupy the central space in the second side bay. Molds are dried in some of these ovens, while cores in wide variety are dried in the others. Tracks from the mold ovens extend into the main bay of the foundry where the cars are loaded and unloaded. To conserve space many cores not needed immediately are stacked on the roofs of the ovens.

Molding and core sands for the iron and steel foundries are secured from deposits in the vicinity of the city. Clean, coarse grain silica sand for the cores and facing sand in the steel foundry is bonded with clay and where temperature conditions are unusually severe a certain amount of silica flour is added to the mixture to increase the refractoriness. Centers of the large cores are filled with coke to facilitate drying in the oven and later to facilitate contraction of the casting.

Part of the space in this bay is occupied by machines for the production of gear wheel molds. Sand first is rammed or swept in a circular flask to form the bottom and wall of the mold. A pattern tooth block then is attached to a revolving arm on the machine. Through a suitable indexing mechanism the block is moved around the circle until the entire set of teeth has been formed. The mold then is removed from the machine and dried in one of the ovens. The arms and hub of the wheel are formed in a set of cores which are placed in position after the mold has been placed on the floor.

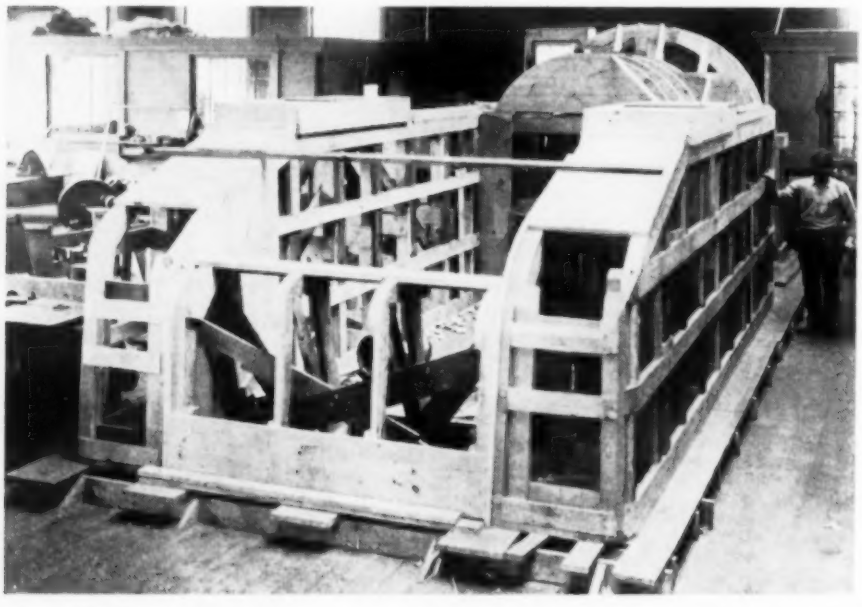


Fig. 13—Skeleton pattern for large engine frame in course of construction in the pattern shop

Ohio Chapter Hears Talk on Heat Treatment

A lively discussion of practical gray iron problems featured the second fall meeting of the Northeastern Ohio Chapter of the American Foundrymen's association held in Cleveland, Thursday evening, Oct. 17. John W. Bolton, chief chemist and metallurgist, Lunkenheimer Co., Cincinnati, presented an interesting address on the fundamental principles underlying the various heat treating practices of cast iron.

Preceding his discussion of that subject, Mr. Bolton stressed the superiority of modern cast irons for a wide field of applications. He discussed briefly the equilibrium diagram for iron, and then explained the practical considerations involved in the four types of heat treatment, namely quick aging, softening anneal, hardening and nitriding.

The speaker pointed out that in any type of heat treatment it is necessary to start with a close grained, quality iron. Unless the base iron is right, satisfactory results cannot be expected. With a knowledge of the fundamentals of cast iron metallurgy as applied to heat treating, and with a good base iron, the foundryman probably will have to undertake a certain amount of experimental work to determine the best technique for the particular class of work.

Mr. Bolton was introduced by Dr. H. A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland, who sketched briefly the early history of heat treatment of cast iron.

An interesting discussion of the paper "Merchandising Castings" presented at the September meeting by J. H. Redhead, Lake City Malleable Co., Cleveland, followed the dinner. L. P. Robinson, sales manager Werner G. Smith Co., Cleveland, and A. C. Denison, president Fulton Foundry & Machine Co., Cleveland, both stressed the importance of the proper pricing of castings.

James L. Wick Jr., president and general manager, Falcon Bronze Co., Youngstown, O., and recently elected vice president of the American Foundrymen's association, was introduced. Walton L. Woody, chairman of the chapter, presided.

A total of 1,440,304 tons of merchant pig iron was produced the first 6 months of 1935, according to a recent report of the American Iron and Steel institute.

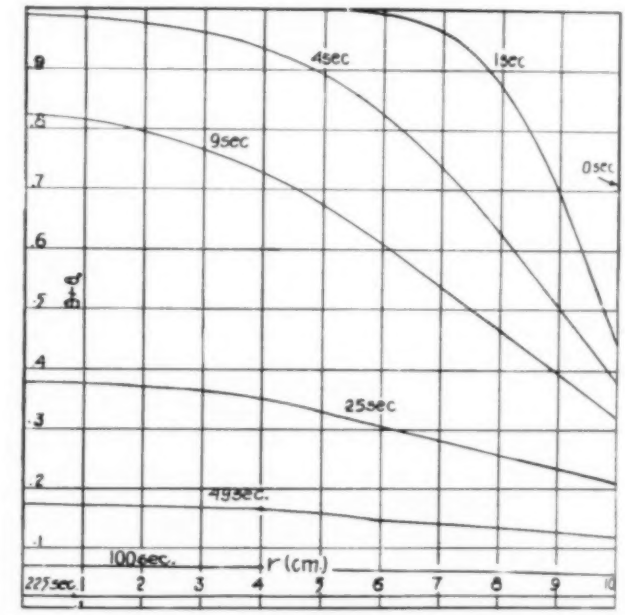
ADVERTISING PAGES REMOVED

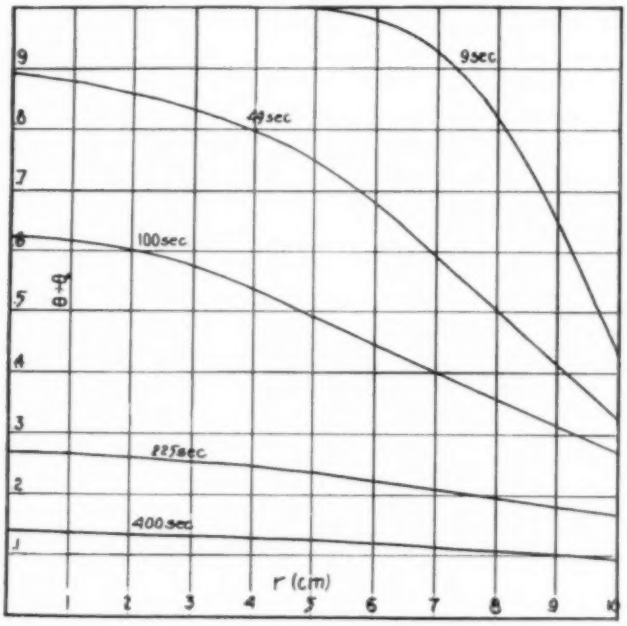
Shrinkage (*First Installment*)

(*Continued from page* 28)

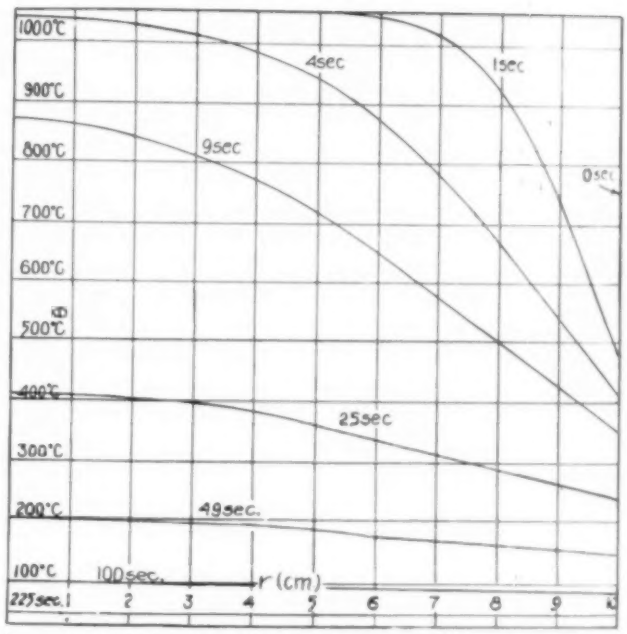
to definite temperatures we may merely remember the scales marking the original and final temperatures at the top and bottom of the temperature scale and subdividing the interval in accord with the selected temperature scale. Since our diagrams are developed for 10 centimeters (about 4-inch) radius spheres only, we may substitute for the horizontal scale originally plotted to show r as a fraction of R the corresponding absolute distances in centimeters. Figs. 4 and 5 represent the temperature distribution in a copper and an iron ball of 10 centimeters radius on cooling from 1050 to 25 degrees Cent.[4]

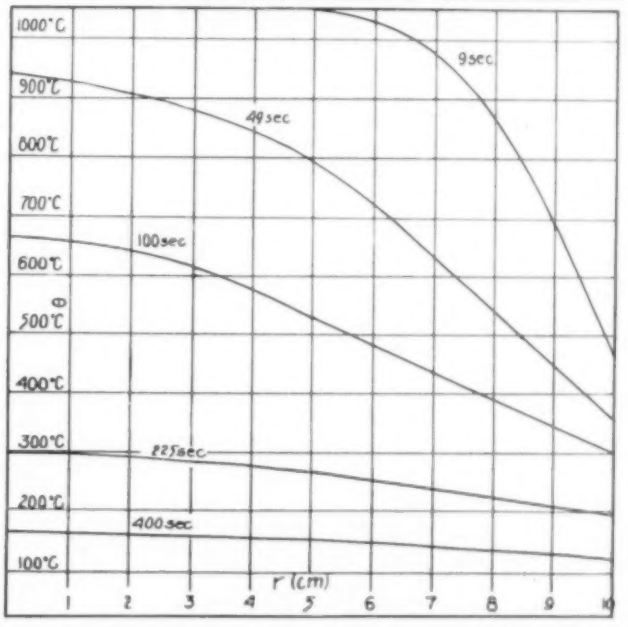
The cooling rate of a body evidently depends upon the diffusivity of the substance by which it is surrounded. The preceding problem represents the condition of infinitely high diffusivity of the surrounding medium. It is approached when quenching a sphere in an energetically circulated and constantly cooled liquid.





Figs. 6 and 7—Relation of temperature at a given time and point in the sphere above the original temperature of the surrounding block of metal to the initial temperature of the globe above that of the surrounding block





Figs. 8 and 9—Problem solved for same conditions as exist in Figs. 4 and 5

It is not feasible to calculate the temperature distribution of a sphere of a given substance when immersed in a medium of any chosen diffusivity but the problem can be readily solved where the diffusivity is the same for the sphere and its container. The relationship of time, temperature and radius is such that no general solution such as summarized in Fig. 1 is possible. The solution must be made separately for each substance and for each size of sphere.

Problem 2

REQUIRED: The temperature distribution in a sphere (a, of copper; b, of iron) at various times after the sphere originally at uniform temperature is enclosed in an indefinitely large body of the same metal as itself, $\theta_0°$, colder than the sphere.

By solution of the equation of the foot-note we obtain Figs. 6 and 7 for the relation of θ the temperature at a given time and point in the sphere above the original temperature of the surrounding block of metal to θ_0 the initial (uniform) temperature of the globe above that of the surrounding block. In Figs. 8 and 9 the problem is solved for the same conditions as exist for Figs. 4 and 5, an initial temperature of the sphere of 1050 degrees

Cent. and of the surrounding substance of 25 degrees cent. (1922 degrees Fahr. and 77 degrees Fahr., respectively).

The conditions of this problem are approximated when metal is poured into a permanent mold made of the same substance. That the solution may apply exactly it is necessary that the mold be so massive that its outer positions do not warm appreciably from the heat of the ball. For this approximately to be so the mold would have to weigh perhaps one hundred times as much as the casting.

The figures show that the surface of contact of the casting and mold instantaneously reaches a temperature just midway between that of the globe and the mold. This might well have been expected even without any calculation.

If the casting and mold are not of the same material this relation would not be expected to hold. We can not, as already pointed out, compute the temperature distribution in the sphere if it differs in diffusivity from the surrounding material. However, we can compute the surface temperatures at the moment of contact.

Problem 3

REQUIRED: The temperature reached by the surface of a mass (a) of copper and (b) of iron immediately after being buried in sand. The metals are supposed to be initially at 1050 degrees Cent. and the sand at 25 degrees Cent.

If θ_1 and θ_2 represent the temperatures of the metal and sand respectively; k_1 and k_2, the conductivities of metal and sand and h_1 and h_2 their diffusivities; then θ_0, the initial temperature of the surface of contact, will be

$$\theta_0 = \frac{\left(\frac{k_1\theta_1}{h_1} + \frac{k_2\theta_2}{h_2}\right)}{\left(\frac{k_1}{h_1} + \frac{k_2}{h_2}\right)} \qquad \text{.....(1)}^4$$

This equation applying as it does *only at the moment of contact* is not greatly dependent upon the size or form of the body of metal although it is derived on the supposition that two very large bodies are brought together at a plane surface. Neglecting corrections for changes with temperature, k_1 is (for copper) 0.918 or (for iron) 0.144. For sand it may be about 0.0037. The diffusivities, h_2, are for copper 1.133, for iron 0.173 and for sand 0.0049; h_1 therefore becomes ($\sqrt{1.133}=$)1.06 for copper and 0.41 for iron while for sand h_2 becomes 0.07.

For copper, equation (1) then becomes

$$\theta_0 = \frac{\frac{0.918\,\theta_1}{1.06} + \frac{0.0037\,\theta_2}{0.07}}{\frac{0.918}{1.06} + \frac{0.0037}{0.07}}$$

$$= \frac{0.866\,\theta_1 + 0.053\,\theta_2}{0.919}$$

$$= 0.942\,\theta_1 + 0.058\,\theta_2$$

and for iron

$$\theta_0 = \frac{\frac{0.144}{0.41}\theta_1 + \frac{0.0037}{0.07}\theta_2}{\frac{0.144}{0.41} + \frac{0.0037}{0.07}}$$

$$= \frac{3.512\,\theta_1 + 0.053\,\theta_2}{3.565}$$

$$= 0.985\,\theta_1 + 0.015\theta_2$$

For $\theta_1 = 1050$ degrees Cent. and $\theta_2 = 25$ degrees Cent. the temperature to which the surface of the sphere cools instantaneously then becomes

990 degrees Cent. (1814 degrees Fahr.) for copper.
1030 degrees Cent. (1884 degrees Fahr.) for iron.

Since the coefficient of θ_2 is very small, obviously the temperature to which the surface cools instantaneously is but little affected by the temperature of the sand and depends almost entirely upon the temperature of the metal. Note also how small is the actual instantaneous cooling of the surface compared to that produced by a metal chill.

We learn also at once that a sufficiently heavy chill will not be raised to above one-half the temperature of the molten metal (temperature measured above that of the chill). Unless the metal is superheated to twice its melting point the chill should not therefore begin to melt. In practice if a stream of hot metal flows over the chill it will melt. This is because as the chill's temperature rises, new metal, uncooled by the chill, is brought up to touch it and the surface finally thus reaches the temperature of the liquid metal. Our problem is solved only for the hot metal being contained quietly in the mold.

It is also plain that, in sand molds, not much superheat is required in order that the metal may not freeze when it touches the mold. This point will be found important later on. Molding sand can not, *if moist*, be above 100 degrees Cent. and even dry sand molds are not likely to be more than 200 degrees Cent. when poured. The temperature of the surface of contact with the mold will bear very nearly the ratios shown in Table I to the temperature of the liquid metal.

Table I

Iron (also steel and cast iron) $0.95 \times$ pouring temperature.
Copper (brass and bronze).....$0.99 \times$ pouring temperature.
Aluminum (and its alloys).....$0.91 \times$ pouring temperature.

Sand molds are generally not of indefinitely large bulk in relation to the casting to be made. This is especially true of larger castings such as those in which shrinkage is a problem. It is possible to solve the problem of the cooling rate of a ball of metal (of high diffusivity) surrounded by a layer of poorly conducting material[7].

If the surface layer conducts sufficiently slowly, as compared with the metal, one may assume that the metal ball is at a uniform temperature throughout. Without some such assumption the problem can not be solved.

(To Be Continued)

[1] The subject is too complex for discussion in the present connection. The interested reader is referred to *Mathematical Theory of Heat Conduction* by Ingersoll and Zobel, Ginn & Co., 1913, for a readable and simple exposition of the more important cases. References to this text will be included from time to time for the student's guidance.

[2] Diffusivity, h^2, is related to specific heat, c; density, ρ; and thermal conductivity, k, by the equation $h^2 = \frac{k}{c\rho}$. Since k, c and ρ, which can be experimentally determined, are usually dependent upon temperature h^2 is dependent on temperature. To make the mathematical treatment possible it is usually assumed constant throughout the temperature range involved. An average value for the temperature range is then chosen.

[3] Ingersoll and Zobel, equation 43, page 133.

$$\theta = \frac{2R\theta_0}{\pi r}\left\{ \sin\frac{\pi r}{R}\cdot e^{\frac{-\pi^2h^2t}{R^2}} - \frac{1}{2}\sin\frac{2\pi r}{R}\cdot e^{\frac{-4\pi^2h^2t}{R^2}} + \frac{1}{3}\sin\frac{3\pi r}{R}\cdot e^{\frac{-9\pi^2h^2t}{R^2}} - \cdots\cdots \right\}$$

[4] No apology is required for the use of the metric system throughout since all the fundamental data are measured in this system. When feasible the approximate English and Fahrenheit equivalents of the metric dimensions are given for comparison.

[5] Ingersoll and Zobel op. cit. page 128, equation 14.

$$\theta = \frac{\theta_0}{r\sqrt{\pi}}\left\{ \int_{\frac{-r}{2h\sqrt{t}}}^{\frac{R-r}{2h\sqrt{t}}} (r + 2h\sqrt{t}B)e^{-B^2}\,dB - \int_{\frac{+r}{2h\sqrt{t}}}^{\frac{R-r}{2h\sqrt{t}}} (-r + 2h\sqrt{t}B)e^{-B^2}\,dB \right\}$$

[6] Ingersoll and Zobel op. cit. page 80, equation 49.

[7] In a mold the layer of sand surrounding even a very simple casting would not be of uniform thickness. The solution would be approximately valid if the mean thickness of sand between the metal and mold surface were selected.

Any Size . . FOUNDRY FLASK .

From the smallest to the largest

Any width
Any length
Any height

No size too large
No service too hard

The larger a flask or the harder the use it receives, the more strength and rigidity are necessary. By using special channels having different dimensions of webs, flanges and center bars we build flasks having the proper strength for all conditions. In other words, we build flasks to suit the job.

Trunnions, pin lugs, handles, bars and clamping lugs are installed as specified.

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Wide flanges give ample bearing on pattern plates.

Flanges can be turned inward or outward as desired.

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Iron Reinforces Concrete Roads

(*Concluded from page* 35)

paving is decreased from about 450 kilograms per square meter for an ordinary concrete road, to about 130 kilograms and even less. Cost of all these systems either is less or not much more than that of plain cement roads, depending upon the nature of the substructure. The upkeep is less, due to absence of joints as well as greater ease of repairing. Repairs are localized readily and are less noticeable. Furthermore, although no long years of experience are available, the behavior of the first applications leads to the assumption that they will have a long life and will depreciate at an exceptionally low rate.

Doubtless the leading field of application for that type of paving will be roads with rather heavy horse-drawn cartage, sloping roads, sections on curves, irregular surfaces, roads giving access to industrial plants, railroad crossings, docks, railroad and steamship piers, bridges and many other surfaces in factories, markets, slaughter houses, etc.

In the *ILVA* road paving, Fig. 2, the network is built up by assembling several triangular elements of cast iron (the *ILVA* system is patented in all the leading countries of the world). The reason preference is given to cast iron instead of rolled stock is due to the fact that the former material is attacked less by atmospheric agents, while its rough surface causes the conglomerate to adhere better, rendering the structure more monolithic. Each triangle is an equilateral, with another smaller triangle inside of it; the sides of the larger measure 30 centimeters while the smaller inscribed triangles measure 15 centimeters on a side. The sides of the triangle are 3 centimeters high, except at the vertices of the angles where they are 5 centimeters high, owing to the feet or lugs which are provided at those points for supporting them and to connect the concrete between cells.

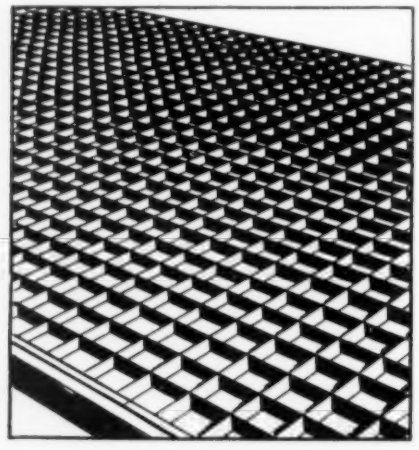


Fig. 4—The Pontam system employs rectangular cast iron elements

The webs are all 5 millimeters thick. Other shapes also are made up for the borders, for curves and for marking the center of the road. For each square meter of surface the *ILVA* system requires about 25 forms having a total weight of 30 kilograms and costing 20 lire.

Among the earliest applications mention might be made of the road which connects the coal mine of the Savona steel mills (with 350 tons daily of traffic by animal traction), the pavement on a section of the national highway of Giovi (with 15,000 tons daily), and the paving of other areas in the plant of the Reffratari di Vado Ligure, in the plants of the Italo-American Petroleum Co., on the highway Principe Amadeo to Savona, etc. Several other sections are at present under construction, on the state highway between Milan and Lodi, on the road between Faentina and Florence, on the road from Francia to Genoa.

The French paving system *Pontam*, patented by the Alti Forni e Fonderie of Pont-a-Mousson, is made up of rectangular cast iron elements as shown in Fig. 4 It is laid in the following manner. On a layer of lean concrete, the thickness varying according to the nature of the terrain and the weight of traffic, a layer of cement mortar 2 to 3 centimeters thick first is spread. On this the *Pontam* elements are placed. After the mortar has set, concrete is spread over the grids, care being taken to tamp it until even with the top of the squares. Tarred or bituminized crushed rock also may be used in place of concrete. The squares can be supplied in the following sizes, according to the character of the applications:

Centimeters	Weight per unit kilogram	No. of units per square meter	Weight per square meter
7 x 7 x 4	0.300	100	30
10 x 10 x 4	0.500	50	25
14 x 14 x 4	0.700	25	17.5
20 x 20 x 4	1.000	12.5	12.5
18 x 18 x 2	0.430	15	6.9

The *Pontam* paving has a good appearance, and the lighter types are particularly applicable for walks and foot-paths subjected to heavy pedestrian traffic. The squares may be filled with concrete even before being laid. In that case the concrete is vibrated. Pavings made in that manner rival in every way those consisting of paving blocks, with the advantage of always having tight joints and edges less subject to wear. Several other types of gray iron reinforcing blocks have been developed by that company. In one the elements assume the form of small spherical latticed domes.

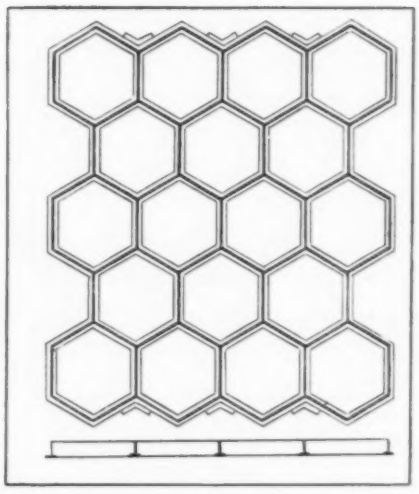


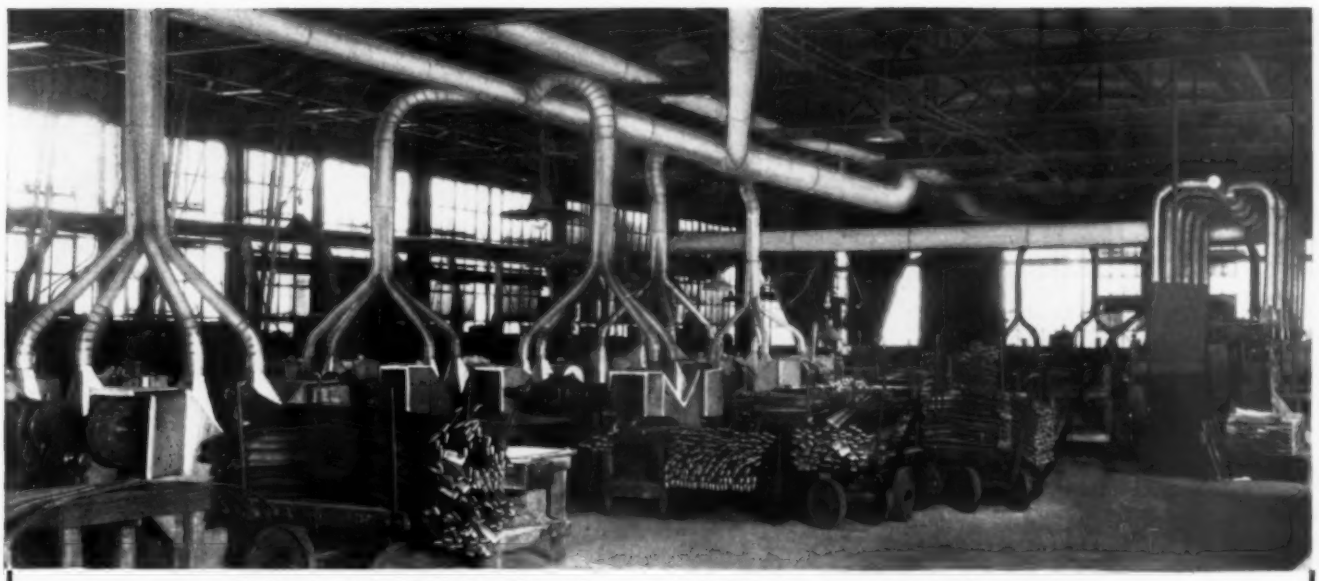
Fig. 5—The Schmid system makes use of hexagonal cast forms

The *Schmid* system, developed in Germany, in the latter part of 1929, makes use of hexagonal forms. The first applications of that type block were made about the middle of 1930. As shown in Fig. 5, each element of the system consists of a grill of cast iron, made up of hexagonal cells having a total weight of 8 kilograms. For every square meter of paving three grills are required having a total weight of 24 kilograms of cast iron. Instead of using concrete, the grids in the system preferably are filled with bituminized crushed rock, the height of the elements being only 2 centimeters. From all reports the system has been used successfully in Germany on mountain roads and elsewhere.

The amount of wear on a paving depends however, in the final analysis, on the quality of the material filling the cells. If it is desired to secure high resistance to wear, granular carborundum or cast iron may be added to the cell filler, or else the concrete may be covered with a layer of "metallized mortar" varying in thickness from 5 to 20 millimeters. For such mortars it is advisable to have recourse to granulated particles of extra hard cast iron having the following particle sizes: 50 per cent running from 1 to 2.5 millimeters, 25 per cent from 0.5 to 1 millimeter and 25 per cent less than 0.5 millimeters. The *Technique des Travaux* has furnished the following table showing the wearing index of different surfaces.

Compressed asphalt	5.75
Straight cement mortar	2.5 to 4.5
Wood paving	4.2
Hard granite	1.8
Metallized mortar	0.7 to 1.6

That publication has also supplied the limiting compositions of the *metallized mortar*: Cement 14 to 20 kilograms; Granular cast iron 8.5 to 16 kilograms; Silicious sand 0.75 to 2.5 liters.



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Overcoming Gas Conditions

(*Continued from page* 33)

free escape of air and gas while pouring.

As shown in Fig. 4 the core of the cylinder is an integral part of the drag. It consists of a 3-inch wall of dried molding sand *A* backed by coke *B* with a 4-inch hole in the center *C*. This hole goes clear through from the top of the cope to the perforated cast iron bottom plate. The 3-inch sand wall is vented vertically through ½-inch vent holes *D* and also is prick vented horizontally *E* to the 4-inch center hole. Care must be taken to prevent metal from entering into the vents.

A coarse and open sand bonded with pitch compound is used for the entire mold. The face of the mold is well blackened with a mixture of plumbago, molasses water and is placed in the oven for overnight drying. The mold is not assembled until it is cooled off and it is poured a short time after.

Metal Gased in Furnace

For years many cylinder linings were cast successfully in this fashion. Nevertheless, in spite of an accurate temperature control and careful molding practice, porous castings were found once in a while. Subsequent tests showed that the metal was gassed as a result of oxidizing furnace or reducing furnace conditions.

As it would have been too costly to melt metal under different furnace conditions and use it to pour these big cylinder linings, two types of smaller castings were selected for studying the effects of furnace gases. One was a standard pump support cover subject to 75 pounds hydrostatic pressure and the other was a small cylinder lining.

In all test cases nothing but ingot metal of the same analysis was used with pouring temperatures and furnace gases as variables. An inexpensive Orsat apparatus was used to determine the volumetric percentages of carbon dioxide, free oxygen and carbon monoxide. Gas samples were drawn from a point in the furnace about 4 inches above the top center of the crucible. The analysis of the natural gas as supplied commercially was:

	Per Cent
Methane (CH_4)	97.0
Ethane (C_2H_6)	1.0
Nitrogen (N)	1.5
Oxygen (O_2)	0.5

The theoretical neutral furnace atmosphere as given by the local gas company was 11.7 per cent carbon dioxide and no oxygen. Three heats were taken with furnace atmosphere alone as the variable.

Heat No. 1

Furnace atmosphere..... neutral
Temperature of metal ..... 2100 degrees Fahr.
Melting time ..... 1½ hours

Characteristics—Little dross, liquid in pouring, normal sinking of sprue head.
Tests: Cylinder lining partly machined revealed a metal free from any holes.
Support cover. Six cast of which 5 were OK: 1 leaking.

Heat No. 2

Furnace atmosphere. Oxidizing (approximately 3 per cent O_2)
Temperature of metal ..... 2100 degrees Fahr.
Melting time 1¼-hours
Characteristics—Excess amount of dross, sluggish metal and swelling of the sprue of the cylinder lining as shown on Fig. 5.
Tests. Cylinder lining partly machined honey-combed with gas holes on the inside, as shown in Fig. 2.
Support cover same as cylinder lining—full of holes; 6 cast, 6 OK, none leaking.

Heat No. 3

Furnace atmosphere. Reducing (approximately 0.6 per cent CO)
Temperature of metal ..... 2100 degrees Fahr.
Melting time 1¼-hours
Characteristics—Little dross, good fluidity, normal sinking of the sprue heads.
Tests: Cylinder lining free from any holes.
Support cover—7 cast and all leaking.

Fig. 5 shows the cross sections of the sprue heads of the cylinder lining castings under neutral, oxidizing and reducing furnace conditions respectively. The center sprue (oxidizing conditions) shows what, in this discussion, is meant by swelling, namely the backing up of the metal in the sprue as the absorbed gases come out of the solution.

The sections of the cylinder linings. Fig. 2, show the type of condition resulting, in these tests, from melting phosphor bronze under an oxidizing atmosphere, so that the condition will not be confused with other possibile gassed conditions, not proven to result from the same cause.

On cylinder linings the tests show quite conclusively that the swelling of the sprue heads and accompanying gassed condition of the metal results from melting phosphor bronze under an oxidizing atmosphere. The higher the pouring temperature of the metal the greater the amount of gases absorbed and consequently a larger amount of gas holes will be found after machining. On the other hand, if a neutral furnace atmosphere exists, even overheated metal will not cause any porous castings, aside from the fact that the hot metal will eat into the sand resulting in rough castings. Additional tests have shown that even 1 per cent oxygen is sufficient for normal pouring temperatures to cause gassed metal. This is true only for a phosphor bronze with 0.10 per cent phosphorus.

It was interesting to find out that an addition of 0.15 per cent phosphorus, or in other words, phosphor bronze with 0.25 per cent phosphorus is sufficient to counteract the presence of 1. per cent oxygen and produce sound castings. Melting the metal under a slightly reducing atmosphere (carbon monoxide 0.6 per cent) produced castings free from any visible gas holes. Tested under 75 pounds hydrostatic pressure, all castings leaked.

Castings Do Not Leak

As mentioned previously, support covers castings poured with metal melted under slightly reducing furnace conditions leaked in spite of the fact that the castings showed no visible gas holes. On the other hand, the support covers cast with oxidized metal did not leak though they were full of gas holes.

The results lead to the general conclusion that the furnace atmosphere for gas furnaces should be maintained at the *real* neutral setting for the melting of phosphor bronze. However, the *real* neutral is a theoretical condition which hardly can be maintained in practice. In other words, even with a small amount of free oxygen present there could still be some combustibles left in the furnace gases. When the furnaces are set for the highest efficiency of combustion, which is undoubtedly the practice of the gas company, a small percentage of oxygen would be justified. It might happen that a certain combination of air and gas line pressures, room conditions, atmospheric pressure, etc. could cause a change in air to gas ratio sufficient to raise the free oxygen from an allowable ½ or ¾ per cent to 2 or 3 per cent. In that case it would be expected

(*Concluded on page* 73)

ADVERTISING PAGES REMOVED

(*Concluded from page 70*)

that cylinder liners poured in phosphor bronze would be porous.

It also was found that the pressure in the air pipes varied from 85 pounds to 110 pounds depending on the number of molding machines and sandblast machines in operation. As the flame is adjusted for an air pressure of 100 pounds, a drop or raise in pressure will cause a reducing or oxidizing furnace atmosphere. Therefore it was found advisable to disconnect the furnaces from the general compressed air system and install a positive pressure type blower exclusively for the brass and aluminum furnaces.

It also was found important to hold the set screw that adjusts the ratio of gas-air firmly in place, as a turn of a few degrees is sufficient to increase the oxygen from 0 to 3 per cent. Vibration caused by the combustion of the gas is sufficient to loosen the adjustment screw. This caused a change of the furnace atmosphere from neutral to oxidizing and as a result several large castings were lost.

Rates Strangle New York Foundries

At a conference presided over by the New York industrial commissioner Elmer F. Andrews, Oct. 16, the Inter-Allied Foundries of New York State through its executive secretary, Eliot Armstrong, pictured the ruinous effects of state compensation rates upon foundries.

At the last session of the New York State legislature an amendment to the workman's compensation law embracing all industrial and occupational diseases not previously compensable gave the basis for the state insurance commission to apply new rates on dust hazards.

Two plans were submitted. Plan No. 1 involved a base rate of $4.63 per hundred dollars of pay-roll supplemented by a deposit in trust with the insurance commission of $300 for each employe. This plan gave full coverage against dust disease.

Plan No. 2 carried the base rate of $1.88 per hundred dollars payroll and $64 deposit per employe. This plan, the first year, gave one-seventh coverage by the state fund with six-sevenths to be borne by the insured in event of sustained claims and contemplated the increase of one-seventh each year until the entire insurance burden would be met from state funds.

It was explained that these base rates applied only to shops with ideal conditions, and at the discretion of the state insurance division, the individual foundry might be assessed an additional amount ranging from 50 per cent to as high as 150 per cent of the base rate.

The Inter-Allied Foundries organization endeavored to secure the cooperation of all foundries in the state to lighten the oppressive burden of this situation. A questionnaire was sent to all foundries and in the few days available time 141 of more than 447 foundries had replied. The interval of time did not permit further assemblage of data, but Secretary Armstrong presented facts which are illuminating as showing the destructive effect of this situation.

Of the number replying, the average pay-roll is shown to embrace an average of 48 employes per plant, totaling 21,456 for the 141 plants. These employes have 71,520 dependents. Of the number replying 11 per cent of the foundries have shut down giving an additional unemployment load to the state of 230 workmen and 10,277 people affected.

The increase in cost due to the dust hazard coverage in steel, malleable, gray iron and nonferrous castings production gives an average of $7.93 per ton. This average increase in cost is applied as follows: Steel foundries, $4.35 a ton; malleable foundries, $4.92 a ton; gray iron foundries, $5.03 a ton; and nonferrous foundries, $12.56 per ton. The New York foundries showed that with this increase and with a freight rate ranging from 6 cents to 35 cents per hundred pounds across the state borders to competing foundries that much business is moving out of New York.

However, the border influence of the insurance matter indicates a direct effect upon employment and wages. The tendency naturally is to employ fewer men and work longer hours. Further, in meeting competition the direct reaction is upon wage structures. While only 4 per cent of those responding have reduced wages to meet these increased burdens, this is taken to indicate an anticipation that the situation soon may be corrected. Of those responding 27 per cent have laid off men and increased hours to escape some of the oppressive burden of insurance assessment.

The effect of the travel of business across state lines is indicated by a summary from the questionnaires showing 46 foundries have lost business which would supply 53,000 days work to inability to meet prices with the added insurance cost.

A committee has been appointed to draft new legislation to present to the next session of the legislature.

Using an X-ray method, one authority has placed the maximum solid solubility of copper in iron at 1.4 per cent of copper by weight. With decreasing temperature, solubility also decreases and is constant below 1200 degrees Fahr. at a value of 0.35 per cent.

Stress Value Of Co-operative Work

In an address at a meeting of the American Institute of Steel Construction, White Sulphur Springs, W. Va., Oct. 16, E. L. Shaner, editor of *Steel*, emphasizes a fundamental precept in the relationship of large and small firms in an industry. Cooperative work, particularly through trade associations leads to understanding and progress in which both types of companies mutually are benefited. Mr. Shaner says:

The steel construction industry is peculiar in that it has a sharp line of demarcation between the few very large companies and several hundred companies of moderate and small size. The problems arising from this distinction are further complicated by certain relations of the larger companies with mill interests.

At the risk of touching upon an extremely touchy subjject, I would like to submit two important premises which sometimes are overlooked. The first is that it is vital to the interest of the large, mill-integrated companies that they use tactics which will help to perpetuate the existence of a large number of small competitors.

This is true not only of the steel construction industry but of all industry. Once this country permits conditions which tend to wipe out the small units and to increase the power of a few large companies, one of two things will happen. The government will be compelled to regulate business, or economic and political influences will force upon us some form of socialism or collectivism, which will be far more terrifying than the New Deal.

Today the existence of small business is the only thing which preventa a more militant action against big business. Moreover, the economic justification of the presence of small units, especially in the steel construction field, cannot be denied.

The second premise is that in any co-operative effort in which large and small units participate with equal freedom, the large companies give up more proportionately in return for what they receive than do the small members. In watching trade associations for twenty years, I have felt that the heads of small companies often are unduly suspicious of the motives of their large competitors. At times such suspicion is well founded, but in the main is likely to be exaggerated.

Mutual understanding and tolerance by both interests is essential, and thus far no agency has been developed which promotes these qualities as effectively as a well-administered trade association.

Tackling dummies used by the Connecticut State college football team have a cast iron base. One size weighing 335 pounds has a 250-pound cast base while the 230 pound size uses 175 pounds of cast iron.

Foundrymen Meet in Brussels

(*Continued from page* 34)

Mines et de Metallurgie de Mons, and various local industries. Many opportunities were given to visit the exhibition and other places of interest.

The annual meeting of the International committee of foundry technical associations was held Sept. 20, with K. Gierdziejewski, president, in the chair. The German delegate issued a formal invitation to hold the Sixth International Foundry congress in Dusseldorf in 1936. The calendar of foundry congresses was brought up to date, as follows: 1936, Germany, congress *A*; 1937, France, congress *C*; 1938, Poland, congress *C*; 1939, Great Britain, congress *A*.

D. Manuel Casanova, representing the recently-formed Spanish association, asked that this association be accepted as a member of the International committee, and that request was granted unanimously. J. Leonard was elected president of the International committee for the year 1936, and the United States was designated to nominate the vice president for that year.

Reorganize Committee

A meeting of the International committee for testing cast iron was held on Tuesday, Sept. 24. A complete plan of reorganization of that committee was submitted and adopted, making for methodical and continuous work.

A post-congress tour was made on Sept. 26, 27 and 28, during which visits were paid to the picturesque region of the Ardennes. The visit ended at Liege, where the works of Societe John Cockerill, Societe Metallurgique d'Esperance-Longdoz, and Cristailleries de Val St.-Lambert were open for inspection.

The first technical session was held Friday, Sept. 20, Professor Thyssen, of the University of Liege, presiding. The first paper, a contribution of the Foundry Trades Equipment & Supplies association, Great Britain, was prepared by G. T. Lunt, director of Bradley & Foster Ltd., Darlaston, and president of the association. This was the first occasion on which the association had presented a paper at an international congress, the title being "Developments of the Production and Use of Refined Cast Irons and Special Alloy Cast Irons in Great Britain." The author explained the method of selecting the materials of a charge to obtain not only the desired analysis, but also the required mechanical properties. He also explained the Bradley method of eliminating gases by agitation of the metal.

The next paper, by L. F. C. Girardet, founder at Saint-Die, France, and past president of the Association Technique de Fonderie, was entitled "'Giree' (agitated by rotation) Cast Iron and the Soda Ash Treatment." The author explained his process of giving the metal a special rotating movement in a forehearth, and also the purification of the iron by soda ash.

The third paper, "Centrifugal Purification of Cast Iron," by E. Vrooner, Compagnie Generale des Conduites d'Eau, Liege, described a method of centrifugation developed in the works with which the author is associated with a view to improving the qualities of the iron. The three papers were discussed together.

L. F. C. Girardet pointed out that the efficacy of methods of agitation and centrifugation mainly is the result of the tendency of cast iron to become purified automatically if left still for a certain time in the molten state. He stated that an agitation without mixing tends to give an emulsion. Centrifugation causes the segregation of unfavorable elements, but does not assist the mixing favorable elements.

A paper on "Soda Ash Treatment in Foundry Practice," by A. G. Lefebvre, Societe Solvay & Co., dealt with application of treatment of cast iron. Professor Thyssen, opening the discussion, pointed out that in researches toward improvement of cast iron, some try to act directly on the iron, while others seek improvement by acting on the flux. Replying to remarks made relative to the possibilities of eliminating phosphorus in the presence of iron oxide, the author said that he considered soda ash caused a catalytic action that favored the combination of the phosphorus with the oxygen coming from the iron oxide contained in the scrap. A speaker mentioned that he employed fluorspar to eliminate phosphorus.

Dr. Marcel Ballay and R. Chavy, French center of information on nickel, presented the French exchange paper, on behalf of the Association Technique de Fonderie, on "Special White Cast Irons—Investigations on the Properties of Certain White Cast Irons Containing Nickel and Chromium." Professor Thyssen pointed out that here was a third process of improving cast iron, by adding special alloys, but this process is more expensive to apply than those previously mentioned.

"Production and Utilization of Irons Containing Titanium and Vanadium" was the title of a paper by J. Challansonnet, Conservatoire National des Arts et Metiers, Paris. Various methods of introducing titanium and vanadium in iron in the blast furnace, with special reference to the electric blast furnace, were explained, and the beneficial effects of these rare elements on the cast iron were described.

A. Le Thomas, director of the Center of Foundry Researches of Houts Fourneaux de Saulnes, contributed a paper on "Industrial Applications of Irons Containing a Low Chromium Content." He dealt with irons containing from 0.3 to 3 per cent chromium. Answering to a question, the author said that refractory cast irons mentioned in the paper, containing about 0.7 per cent chromium, stood up to a temperature of 800 degrees Cent. J. Varlet stated that the results obtained by the author with silicon-aluminum irons confirmed the investigations made by Thyssen and others in 1931.

A paper, "Improvement of Cast Iron by Heat-Treatment," was contributed by Prof. E. Piwowarski, director of the Foundry Institute of Aachen, Germany. The author shows that the aptitude to improve drops suddenly when a certain total content of carbon and silicon is exceeded. Professor Thyssen pointed out that heat-treatment is again another method of improving cast iron. L. Jenicek, of Czechoslovakia, referred to the internal stresses that can be developed in the course of treatment, especially in complicated castings. Dr. Piwowarski explained that present investigations are not yet completed and conclusions in that direction are not quite definite.

Discuss Alloy Irons

Mr. Delbart referred to the work of Ballay, Galibourg and Chavy, where it is shown that quenching and hardening has been successful with nickel-chromium irons. The speaker has also experimented with manganese irons and has obtained good results, especially as regards the shearing test. Dr. Ballay stated that interesting results can be obtained up to a certain percentage of carbon; beyond a certain point there is merely an increase in hardness. For good friction qualities it generally is accepted that the fracture should show masses of graphite embedded in a network of hard elements. With reference to internal stresses, quenching in water, or even oil, does not give good results. It is necessary to have either castings that lend themselves to a heat-treatment or irons that will lend themselves to improvement by slow cooling.

The exchange paper of the Czech foundry technical association was presented by Dr. Ing. E. Valenta and Dr. Ing. F. Poboril, research department, Skoda works, Plzen, the title of the paper being "Influence of Titanium on Primary Crystallization, Especially in Steels Without Alpha-Gamma Transformation." The authors show that small additions of titanium increase the fineness of the primary grain, both in carbon steels and special steels. This is all the more interesting as it applies to steels, the structure of which cannot be improved by heat-treatment.

The second session took place on

(*Continued on page* 76)

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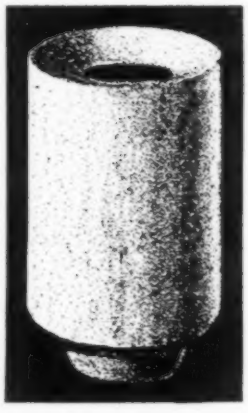

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(*Continued from page 24*)

Saturday, Sept. 21, with J. Hiernaux, director and manager of Universite du Travail, of Charleroi, in the chair.

The first paper, "Spongey Porosity and the Leonard Effect," was by M. Kagan, of Ateliers de Construction de la Meuse. R. Chavy said the author implied porosities were due to escape of gases from the mass of the metal, without referring to the quality of the metal. Mr. Chavy stated that he had had to deal with porosities in automobile castings, and he avoided this defect by acting on the metal. He described a case where he thought the defect was due to too large a solidification range, which, incidentally, gives more time for the gases to escape through the metal. He replaced the iron he was using by an iron containing a lower percentage of carbon and phosphorus, and succeeded in doing away with the defect. A. Le Thomas confirmed Mr. Chavy's remarks and mentioned the influence of oxidation. He said that in some foundries where they are successful in turning out sound castings, molds are made carefully without any chills, and the irons used are chosen so as not to give the chilling anomaly. However, he stated, the phenomenon referred to by Mr. Kagan also played an important part.

Defective Steel Castings

The exchange paper of the Polish foundry technical association, entitled "Sound and Unsound Steel Castings," was by Jean Obrebski, engineer at Hauts-Fourneaux et Usines d'Ostrowiec. The paper describes causes of fissures in steel castings and lack of cohesion between crystals. He suggests that these defects are due to too slow a solidification, too large a quantity of dissolved gases in the liquid metal, chemical disequilibrium, a large interval of time between the beginning and the end of solidification, and insufficient deoxidation.

Fr. Boussard, Compagnie Generale des Conduites d'Eau, Liege, contributed a paper on "Ramming Sand With a Hand-Rammer." He stated that the weight of the rammer is of considerable importance to obtain satisfactory ramming, and that for large molds the weight of the rammers should be as much as 10 pounds, and in some cases a 22-pound rammer should be used with both hands. Rammers for ordinary molds, the weight of which usually ranges from 3 to 5 pounds, could be increased usefully to a weight of 7 pounds. The rammer should be used lightly, and in view of the recommended increase in weight, the area of the rammer should be increased so that pressure per unit of surface of the mold should not become too great.

The next paper was entitled "Manufacture of Piston Rings: Casting and Heat-Treatment," by Jean Challansonnet, engineer, Conservatoire National des Arts et Metiers, Paris. R. Chavy stated in the discussion that it is possible to obtain a satisfactory modulus of elasticity in the shearing test and good wearing qualities by using special cast irons. It is necessary to obtain a pearlite-graphite structure without cementite. An iron containing additions of silicon and chromium gives good results, and satisfactory machining qualities can be secured by a correct heat-treatment. It usually is necessary to have a relatively high content of graphite. Mr. Challansonnet remarked that a high proportion of graphite usually means a low modulus of elasticity, but Mr. Chavy replied that in a works specializing in airplane engines a proportion of 3.4 per cent of carbon was specified, of which about 2.7 per cent was graphite, and that the results were consistently good.

Exchange paper of the Dutch foundry technical association, entitled, "Investigations on Artificial Binders for Making Cores," was presented by A. Swagerman, G. Dikkers & Co., Hengelo. Two principal factors to be considered to obtain a high value in artificial binders are as follows: (1) Hygroscopic degree; (2) measure in which gases can be evacuated through the core. A number of tests were made to enable a comparison between various kinds of oils to be made. The author also stated that it is not possible to standardize the characteristics of a satisfactory binder, owing to the various conditions pertaining to different foundries.

Exchange paper of the German foundry technical associations, entitled, "Suggestions for an International Agreement on Methods of Controlling Molding Sands," was presented by Professor Aulich, of Duisburg. The paper refers to the work effected by the sands committee of the American Foundrymen's association and to the standardized methods used in the United States. He suggested that a special committee should be established to adopt international standard methods.

The next session of technical papers was held Tuesday, Sept. 24, Professor Rabozee, Ecole Militaire de Belgique, presiding. A paper entitled "Some Principles Relative to the Pouring Properties of Aluminum Alloys," by Dr. Irrmann, of Neuhausen, gave examples showing the part played by castability on the characteristics of the casting. Referring to this question of castability, Dr. Ing. Meyersberg, director of the Edelgussverband, Berlin, described a castability test-piece in the form of a spiral as used in Germany and which has a different section and different dimensions from those used in Belgium and France.

Marcel Remy, managing director of Usines et Fonderies Marcel Remy, Herstal, contributed a short paper "Suggested Standardization of the Castability Test-Piece," in which he recommends a uniform method of testing castability be adopted internationally. Replying to a remark made to the effect that the test-piece suggested by Mr. Remy showed some difference in comparison with the test-piece adopted by the Belgian association, Mr. Remy indicated that the test-piece he was suggesting was intended to be used for practical purposes in the foundry, whereas the test-piece used by the association would be more adequate for precise research work.

V. C. Faulkner, past-president of the Institute of British Foundrymen, presented the official exchange paper of the institute on behalf of the author, H. H. Beeny, the subject of the paper being "A Study of the Machining Problem, With Particular Reference to Cast Iron." The author reviewed the various characteristics of cast iron in relation to effects on machining properties. Among his conclusions he stated that for maximum machinability castings must be fully annealed, as this treatment reduces both the tensile strength and the combined carbon to the greatest extent. He also made the statement that rapid machining and high engineering quality are to some extent opposed, but as a reasonable compromise, and considering also tool life and surface finish, the following composition appears to be the best for the machining of unannealed castings and also those which have to be annealed: Total carbon 3.00 per cent; combined carbon 0.45 per cent; silicon 2.70 per cent; manganese 0.50 per cent; sulphur 0.10 per cent; phosphorus 0.80 per cent.

Presents Spanish Paper

The exchange paper of the recently-formed foundry technical association of Spain was presented by Prof. J. Navarro Alcacer, professor of metallography, Ecole Superieure du Travail, Valencia, the title being "Contribution to the Study of Internal Stresses and the Work of Deformation in Gray Cast Iron." Dr. Ing. Meyersberg stressed the importance of Prof. Navarro Alcacer's investigations, pointing out that the work as indicated in tests by the use of a testing machine is not the same as the figures given for work as obtained by diagram. The author of the paper has shown the causes and importance of the difference between the two works. Dr. Meyersberg stated the internal stresses are due to an external force travelled around the graphite flakes, and the bigger the graphite flakes, the bigger the stresses. He said that the question was far from being completely elucidated, and he expressed the hope that Prof. Navarro Alcacer would continue his investigations in that direction.

A paper "Practical Remarks on the Present Stage of Manufacture of

(*Concluded on page 78*)

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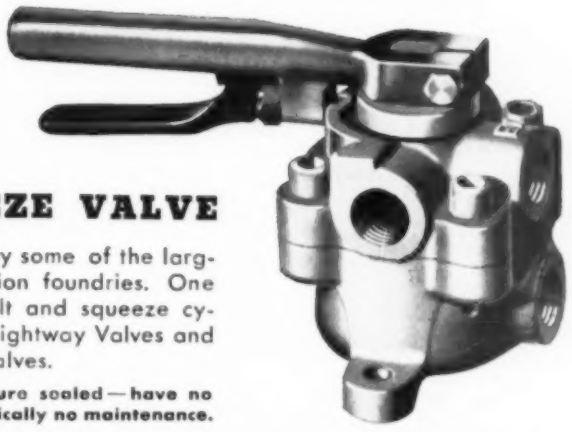

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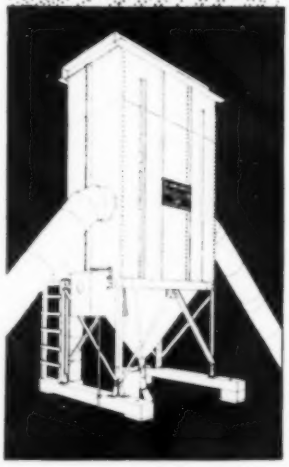

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The HANNA FURNACE CORP.
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(*Concluded from page 76*)

High-Duty Cast Irons," contributed by Prof. A. Portevin, professor at the Ecole Centrale des Arts et Manufactures, Paris, and R. Lemoine, professor at the Ecole Superieure de Fonderie, Paris, reviewed the question from a practical angle and presented a number of observations based on experience of the production of high-duty cast iron in various countries.

Rene Paquet, professor at the Ecole des Mines et de Metallurgie of the Technical Faculty of the Province of Hainaut, contributed a paper on "The Proportions To Be Given to Fillets in a Casting." The author showed, by means of tests made on flywheels, that the design of the fillet linking the arms to the tire has a considerable influence on the resistance of the iron, due to its effect on the cooling of the casting. Dr. Ing. Meyersberg took this opportunity to remark that iron is better than steel from the point of view of shearing resistance, and he stated that this point was of special interest in the case of a flywheel.

Reviews Malleable Iron

The exchange paper of the American Foundrymen's Association was prepared by Dr. H. A. Schwartz, director of research, National Malleable & Steel Castings Co., Cleveland, and dealt with "The Field of Malleable Cast Iron." That paper was presented by Marcel Remy, managing director of Usines et Fonderies Marcel Remy, Herstal. In his paper the author reviews the position of malleable cast iron practice in the United States during recent years, and gives interesting information in connection with the heat-treatment of malleable cast iron and the measurement of temperatures. The paper was followed with considerable interest by a large number of malleable iron founders from different countries, and it seemed that the only point on which some difference of opinion exists between American and European founders is on the subject of classification, and this point was particularly brought out in the next paper, by Marcel Remy, in which the author suggests the following classification:

Ferritic malleable with tensile strength from 30-35 kilograms per square millimeter and elongation of 20 per cent on a test-piece having a diameter of 6 millimeters; pearlitic malleable with tensile strength ranging from 40—50 kilograms and elongation of 3—5 per cent on a test-piece having a diameter of 12 millimeters; ferrite-graphite malleable, with tensile strength ranging from 30—40 kilograms and elongations varying from 6 per cent on a 12-millimeter test-piece to 10—15 per cent on a 16-millimeter test-piece.

The last session of technical papers was held Wednesday, Sept. 25, under the presidency of Prof. Sylvain Perin, Ecole des Mines et de Metallurgie de Mons. This session was mostly concerned with discussions on furnaces used in foundry practice. The first paper "High-Pressure Die-Casting for Alloys" by Dr. Ladislaw Jeniceck, engineer at the Polytechnic School, Prague, describes methods and machines used for die-casting alloys under pressure, including copper and zinc alloys and light alloys. A. Brison, managing director of Fonderie A. Brizon, Courbevoie, Paris, stated that this industry is a relatively new one. Thanks to recent progress made in design of die-casting machines, it is possible to cast alloys having a high melting point at a pressure of 800 kilograms per square millimeter, and the tendency is to use such high pressures also for alloys having a lower melting point. He said that investigations are being made to discover relations between the pouring temperature, pressure under which the metal is poured, speed of injection of metal and section of the opening through which metal is injected for a series of alloys. Answering to a question, he stated that some castings present blowholes, which become smaller and smaller, until they are of microscopic size, as the pressure of injection increases.

The name of the author of a paper on "The Applications of Electricity in the Foundry," was not given. This paper dealt with arc furnaces, resistance furnaces and induction furnaces as used in foundry practice, and was followed by a contribution by Henri George, director of the Laboratory of Electro-Thermics of Compagnie de Saint-Gobain, the subject of the paper being "Radiation Electric Furnaces With Graphite Resistance." The author described a furnace composed of a shell and in which a graphite bar is brought to a high temperature, owing to the resistance it creates against the passage of electric current, and the heat in the furnace is obtained by the radiation from the graphite bar. Mr. Boutigny also contributed a paper on the use of electric arc furnaces in the foundry.

Fr. Boussard, Compagnie Generale des Conduites d'Eau, Liege, presented a paper on "Comparison Between Irons Obtained in the Cupola and in the Rotating Furnace Fired By Pulverized Fuel." Replying to a question by Dr. Ing. Meyersberg, who wished to know how the carbon content could be increased when steel scrap was charged in a rotating furnace, the author stated that this could be done simply by adding anthracite, provided that the addition is made at the proper time. R. Chavy confirmed this statement and said that carbon, which could be added even in the form of ordinary coke, was to be added at the time when the metal is in a pasty state.

"Rotating Furnaces in the Foundry" was the title of a paper by Mr. Boutigny, who reviewed the progress made in recent years in the design of rotating furnaces and their use for the melting of special irons, malleable iron, steel, bronzes, and other alloys. A speaker mentioned that a new oil-fired rotating furnace for melting steel has just been designed, offering the following characteristics: Time required for melting 1 ton of steel from cold, 2 hours 40 minutes, the following melts taking 1 hour 40 minutes; consumption of fuel after the first melt, 18 per cent; pouring temperature, from 1600-1700 degrees Cent., a temperature of 1760 degrees being obtainable; melting loss, 6 per cent; acid lining lasted for 55-60 melts. Characteristics of the metal obtained were: tensile strength, 48-50 kilograms per square millimeter; elongation, from 29-32 per cent. This furnace also is said to be adaptable for deoxidizing metal.

Guy Henon, Center of Researches of Hauts-Fourneaux de Saulnes, contributed a paper on "Melting Losses in Cupola Melting," in which he suggests a simple method of calculating melting losses by measuring the weight of the slag and determining its composition in iron oxide, which gives the weight of iron lost through oxidation during melting.

At the end of this session, J. Leonard, president of the Association Technique de Fonderie de Belgique, formally closed the meeting by reviewing the papers that had been presented during the congress.

Book Review

Practical Metallography (Praktische Metallkunde), by Georg Sachs, fabrikoid, 240 pages, published by Julius Springer, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland.

This volume, which is in German, is the second section of the author's work on practical metallography, and deals with forming and working of metals. The book is divided into three sections covering various phases of the processes. The first section is devoted to the general laws of forming or working metals and discusses cold working, drawing and annealing, hot-working, and the basis of mechanics of working. The second section covers in detail the internal stresses in worked metals, and relates to such phases as characteristic internal stress, cracking of brass, mercury testing of brass, cracking of other metals and alloys, etc. The third section presents data and information on various metal working processes.

ADVERTISING PAGES REMOVED

Gray Cast Iron (*Chapter VI*)

(*Continued from page 37*)

Nickel decreases the percentage of combined carbon required for an eutectoid matrix, in the neighborhood of 0.05 per cent carbon for each per cent of nickel.

Although the possible utility of nickel in cast iron first was considered about 135 years ago its real utility has been recognized, and its applications have been widely promoted only within the last 15 years. Foundrymen are alloy conscious, and nickel easily ranks first in tonnage among alloy elements added to cast iron. The following three ranges of nickel content are of special interest:

1—Low nickel, content 0.5 to 2.00 per cent

2—Medium nickel, 4.00 to possibly 10.00 per cent

3—High nickel, 12.00 per cent up to well over 20.00 per cent

The great bulk of so called nickel irons are found in the first range, carrying from 0.5 to 2.0 per cent nickel. Within that range the major effects of nickel, when added to irons of suitable composition are as follows: (a) Tendency toward graphitization of free carbide (if this normally would be present in absence of nickel.) (b) A perceptible hardening of the matrix due to pearlite lamination being made finer, and approaching a sorbitic structure as the nickel content is increased. These influences first were described by Guillet—*Comtes Rendus*, vol. 145, page 552, 1907. Among the many papers dealing with the influence of nickel, those of Piwowarsky (Germany) Everest (England) and Wickenden and Merica (United States) are of special interest.

Is Not Paradoxical

The statement that nickel is at once a softener and a hardener is not paradoxical. For instance, consider a casting of unequal sections, such as the step test bar, Fig. 75. Obviously with carbon content constant an iron suitable for the heaviest section should be low in silicon and hence quite likely to chill in the very light section. Conversely, a high silicon content, suitable for the lightest section likely would cause the heavy section to be low in combined carbon, weak and open grained. Such a condition is more likely in high carbon cast irons, which change more in structure with change in section than do the lower carbon metals. Fig. 75 shows a high carbon low silicon iron with and without nickel. The caption is self explanatory. Nickel eliminates the chill in the light section, and, due to sorbitizing action, hardens the heavy section.

Nickel is apparently about half as effective as silicon in graphitization of free (eutectic and pro-eutectoid) cementite. The reaction in gray irons is peculiar in that nickel and silicon apparently act cumulatively in graphitization of free cementite but below the eutectoid transformation, nickel, under the cooling conditions prevailing in ordinary castings sections, apparently does not readily graphitize the combined carbon (cementite) of pearlite and conceivably may retard somewhat the graphitizing action of silicon. Silicon alone, within a certain range, decomposes the pearlitic as well as the massive carbide. These effects are influenced by other factors such as percentage of carbon, melting practice etc. so that only general observations can be made.

Schwartz—*Transactions, American Society for Steel Treating*, 1928, vol. 15, pages 957-966—experimenting with the graphitization of white iron, silicon 0.85 per cent; carbon 2.75 per cent; nickel 0.0 to 2.49 per cent, concludes that in the presence of even rather low nickel concentration silicon becomes inactive as an accelerator of graphitization, as the graphite formed by given heat treatments is nearly proportional to the nickel contents.

Everest and Hanson—*Foundry Trade Journal*, May 2, 1928, page 315—conclude that phosphorus tends to reduce the influence of nickel on iron.

Nickel is said to refine the graphite

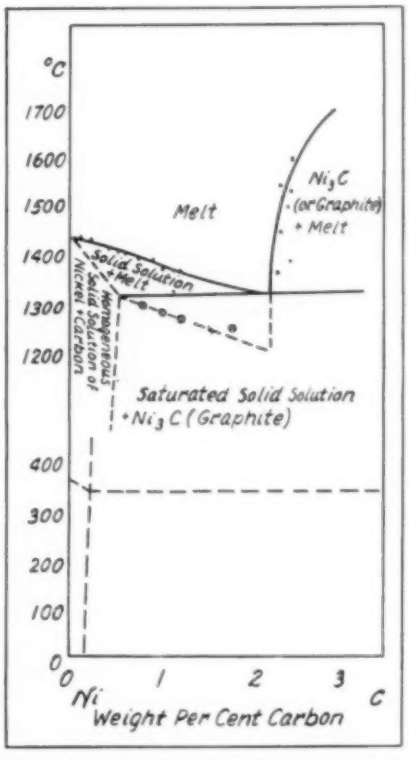

Fig. 74—Equilibrium diagram of the nickel-carbon system, according to Kase

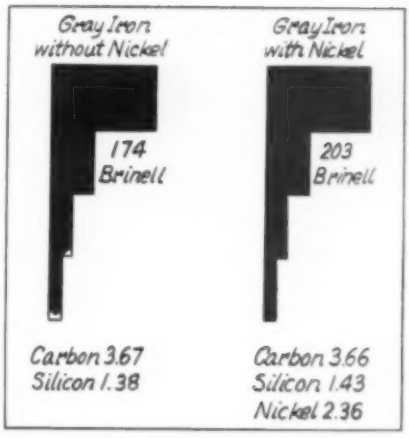

Fig. 75—Step bar casting of high carbon, low silicon iron, with and without nickel

grain structure especially if the composition is balanced by reduction of carbon and silicon to make use of the extra graphitizing power of the nickel. Under ordinary conditions it apparently has little affect on fluidity and contraction. In itself it will not prevent shrinkage, but suitable ratios of silicon and nickel may be employed to prevent excessive graphitization in certain types of castings, hence lowering the tendency toward porosity. Nickel apparently has little direct affect on the tensility of most cast irons. When employed to offset the carbide forming tendencies of elements like chromium or in irons of low silicon content combinations may be evolved which help the tensility of the iron.

In lowering the austenite-pearlite transformation point, decreasing the critical quenching speed, and stabilizing the eutectoid carbide, nickel is of advantage in some irons to be hardened by heat treatment.

Suitable Base Iron Needed

The major benefits attainable from employment of nickel usually are traceable to its tendency to equalize the structural conditions in castings of varied sections. Intelligent application necessitates employment of a suitable base iron, nickel usually being substituted for a part of the silicon. The major effects are well illustrated in Figs. 76 and 77, after Everest.

How far the metallurgist can go without reverting to use of special alloys has been hotly debated. Generally speaking, in castings of uniform section it usually is not necessary to employ special alloys. In castings of varied section more than usually is suspected can be accomplished by adjustment of carbon and silicon alone. For example, consider the fractures shown in Fig. 71. Metal of 2.75 per cent carbon and 2.40 per cent silicon, from the same ladle, was poured in bars 21 inches long. The ½-inch diameter bar is free from any free cementite and is 242 brinell.

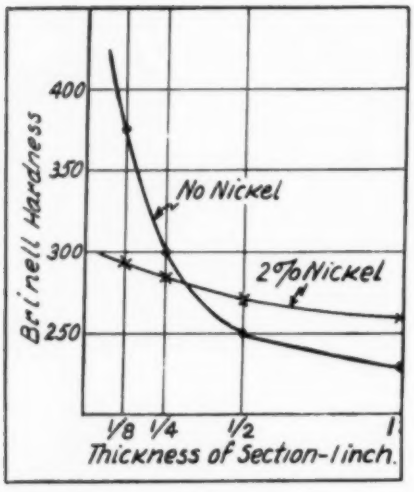

Fig. 76—Comparison of nickel on hardness of section, according to Everest

The heavy 3-inch diameter bar is 201 brinell, and tests across a polished section showed a variation of less than 10 points brinell from center to outside.

At about 4.5 per cent nickel, cast irons become noticeably martensitic in structure. With increase to 8 or 9 per cent when cast into 1.25 inch diameter test bars, these become quite fully martensitic. The amount of nickel necessary to produce a martensitic structure obviously depends somewhat on the size of the section and the composition of the iron. These martensitic irons are hard (usually 400 to 500 brinell) and quite wear resistant. Such irons are practically unmachinable with ordinary high speed tools, but certain operations are conducted successfully using tungsten or tantalum carbide type tools. Irons with nickel just below the martensitic range, 3.5 to 4.0 per cent, can be hardened by air quenching.

Metal Resists Corrosion

Above 12 per cent nickel most cast irons show appreciable austenite formation and at 20 per cent or thereabouts they are fully austenitic matrix, as opposed to the ordinary pearlitic matrix of gray irons without the special alloys. The term austenitic irons is applied aptly to the high nickel and high nickel-copper irons, known in the trade as Ni-Resist, Ni-Mol, Causul Metal, etc. These metals are not attracted by magnets and have quite unusual corrosion resistant qualities. It has been found that copper can be substituted for some of the nickel, a metal say 15 to 18 per cent nickel and 3 to 7 per cent copper being austenitic in matrix. The high alloy content reduces the ability of the metal to contain carbon and the usual range of total carbon content is 2.3 to 3.0 per cent according to the alloy and silicon content. The straight high nickel and nickel copper irons usually are low in tensility, 15,000 to 18,000 pounds per square inch, and their deflections are from two to four times those of the corresponding gray irons. The high nickel content causes rather complete graphitization. To counteract this it is customary to add chromium, usually 1.5 to 2.5 per cent. Resulting materials generally run about 25,000 pounds per square inch tensile, 150 brinell and 0.30 to 0.50 deflection, on a 1.2-inch bar on 12-inch span. They readily are machinable. Tensile strength and hardness can be increased by increase in chromium content.

Austenitic irons are quite resistant to growth and scaling. These properties and corrosion resistance are covered in greater detail in later chapters.

The effect of nickel on the co-efficient of expansion of austenitic irons is illustrated in Fig. 78. At between 20 and 22 per cent of nickel the iron reaches a maximum co-efficient of expansion, while further additions of this element gradually lower the expansion to reach a minimum at 34 to 35 per cent. Still further additions result in a gradual increase. Thus, by selecting the proper nickel content, an iron can be made with a coefficient of expansion within a rather wide range.

Manganese also has been used in conjunction with nickel in the production of nonmagnetic or austenitic irons.

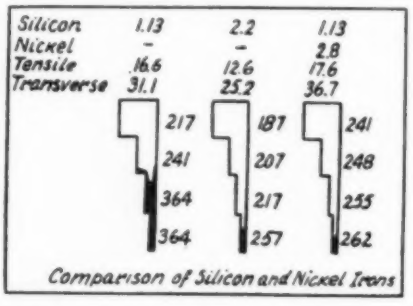

Fig. 77—Step test bars showing comparison between silicon and nickel irons

Addresses Meeting On Profits and Losses

Sam Tour, vice president, Lucius Pitkin Inc., New York, addressed the members of the Metropolitan chapter of the American Foundrymen's association at the Engineers club, Philadelphia, on Oct. 11. Mr. Tour spoke on "Profits and Losses in a Foundry". Robert W. Phillips, manager of the Salvage and Reclamation department, E. I. duPont de Nemours, spoke on "The Romance of Waste".

Adopts Test Bar Control for Iron

(*Concluded from page* 31)

and watched carefully. With comparatively hard iron showing a silicon content of 1.50 per cent or less, the chill increases rapidly with comparatively small decreases in the silicon content. For example with a 1.00 per cent silicon content the test block will show a chill depth of 1 inch. By following the method as outlined in the foregoing description the foundryman can determine with sufficient accuracy the hardness or softness of his iron for all practical purposes. The test blocks may be molded and cast readily in a chill mold close to the cupola.

The method is advantageous and desirable in any type of gray iron foundry, even in those where a uniform or standard mixture is melted daily. It provides a check on the daily routine particularly when changing from one brand of pig iron to another, or when changing from one carload to another from the same shipment.

With the adoption of this method as a base, the foundryman can devise a permanent standard for the classification of his different mixtures. Working in close collaboration with the engineering department, these mixtures will be called for on the shop specifications and also will be shown on the foundry work tickets. For example if a pulley iron of about 2.25 silicon content is desired in a certain casting, the engineer would specify *A* iron. If a 2.00 per cent silicon content is wanted the engineer would specify *B* iron and so on down the line.

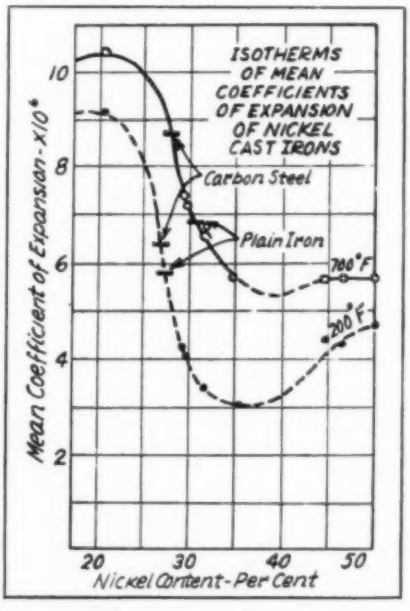

Fig. 78—Chart isothermis of mean coefficients of expansion of nickel cast irons

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especially for
the foundry and
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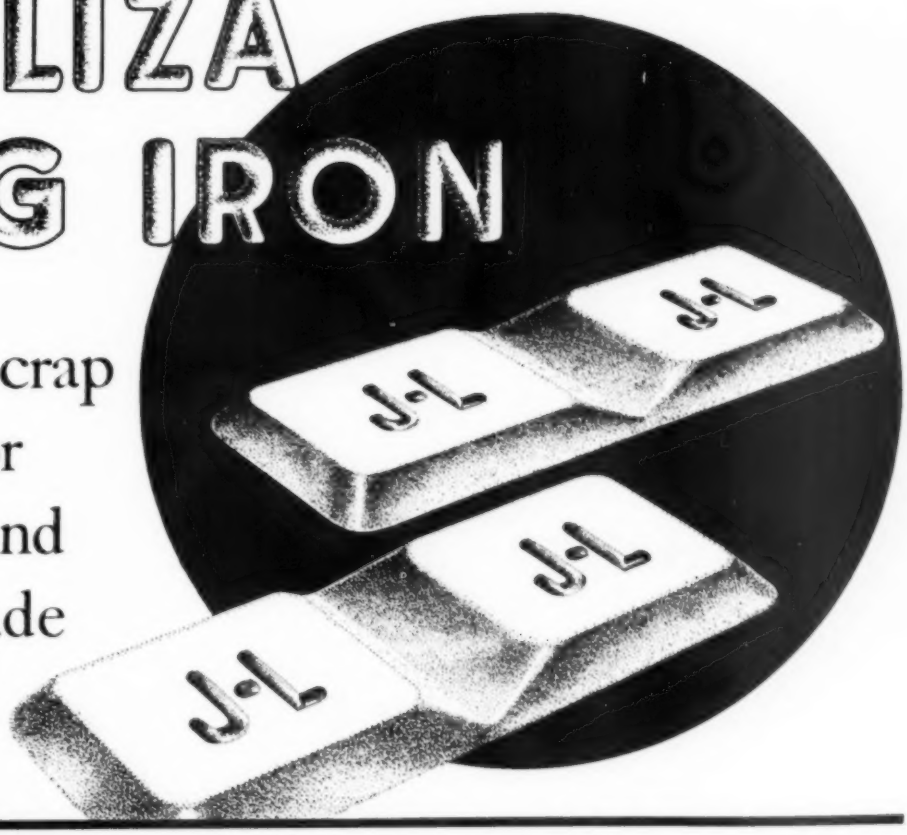

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"BRUINELLA"
The Antipiping Compound
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Obituary

JAMES F. DIGAN, 72, president, Logansport Radiator Equipment Co., Logansport, Ind., died Sept. 30 following a prolonged illness. Mr. Digan went to Logansport 35 years ago from Marion, Ind., to assist in the founding of the Logansport Foundry Co., which later became the Western Motor Works and Rutenber Co. Several years later he founded the Logansport Radiator Equipment Co. He also was president of the Pharos-Tribune Co., publisher of the *Pharos-Tribune;* director of the Logansport National bank, second congressional district chairman of the state unemployment relief commission, and Cass county chairman of the Federal Housing act.

Mr. Digan was born in Springfield, O., June 10, 1863, and received his elementary education in the public schools of that town. When only 15 he secured work as a molder for the Evans-Foos Co., Springfield. At the age of 17 he was elevated to boss foreman and served in that position until 1882 when he joined the Moss-Foos Co., another foundry. When 21, he became connected with the Southern Malleable Iron Works, Chattanooga, Tenn., and continued with that company until 1890 when he worked for the Terre Haute Car Works, a division of the American Car & Foundry Co. In 1892 he went to Marion, Ind., to assist in the founding of the Marion Gray Iron Foundry and the Marion Malleable Iron Works, becoming general manager of both companies.

♦ ♦ ♦

James Clark Jr., president, James Clark Jr. Electric Co., Louisville, Ky., died Oct. 9.

♦ ♦ ♦

Frank J. Stevens, 73 formerly general foreman, International Harvester Co., Chicago, died Oct. 13. Mr. Stevens retired 10 years ago.

♦ ♦ ♦

E. Homer Fahrney, 59, founder and president, Universal Foundry Co. and Universal Motor Co., Oshkosh, Wis., died recently.

♦ ♦ ♦

William A. Herron, retired president, Lewis Foundry & Machine Co., Groveton, Pa., died in Pittsburgh, Oct. 27.

♦ ♦ ♦

John Faulkner, 62, former foreman of the brass foundry, Bishop & Babcock Mfg. Co., Cleveland, died Oct. 9 at his home in Lakewood, O., following a long illness.

♦ ♦ ♦

Richard Denbigh, 75, who retired as vice president of the Hay Foundry & Iron Works when it was merged with the Bethlehem Steel Co. in 1931, died at Newark, N. J., Oct. 8. Mr. Denbigh had been with the Hay foundry for 56 years when he retired.

♦ ♦ ♦

Frank A. Hatch, president, Shepard Niles Crane & Hoist Co., Montour Falls, N. Y., died Oct. 15. Mr. Hatch was born Nov. 2, 1877 in Bay City, Mich., and graduated from the University of Michigan in 1900.

Frank A. Hatch

Three years later he went to Montour Falls as treasurer of the Pneumatic Tool Co. In 1917 he became vice president and general manager of its successor, the Shepard Electric Crane & Hoist Corp. and in 1929 was elected president and a member of the executive committee of the Shepard Niles Crane & Hoist Co. He also was a director of Niles-Bement-Pond Co., New York.

♦ ♦ ♦

George G. Durham, 63, former general manager of the Niagara Falls Machine & Foundry Co. and more recently with the Ontario Hydro Electric commission, died recently at his home in Niagara Falls, Ont.

♦ ♦ ♦

Ernest S. Hirschberg, 52, chief engineer, Dings Magnetic Separator Co., Milwaukee, died Oct. 10. Mr. Hirschberg was graduated from the University of Wisconsin in 1907 and became affiliated with the Dings company in 1914.

♦ ♦ ♦

Dr. F. W. Weissmann, originator of the parting compounds that are now in general use throughout the United States, died at Karlsbad, Germany, Oct. 8. He was a chemical engineer in the University of Cincinnati, and for the past 30 years had been connected with the Hill & Griffith Co., Cincinnati.

♦ ♦ ♦

Irwin Sheldon Osborn, 56, vice president, C. O. Bartlett & Snow Co., Cleveland, died at Lakeside hospital, Cleveland, Nov. 2. Mr. Osborn was born in Bay Village, O., and was a graduate of Oberlin college and Purdue university. In 1922 he joined the C. O. Bartlett & Snow Co., becoming vice president and director. Mr. Osborn was an expert in waste collection and disposal problems and superintendent of construction at incinerator plants in Cleveland, Columbus, Montreal, New York, New Orleans and Birmingham.

♦ ♦ ♦

Palmer Hall Langdon, founder, editor and publisher of *Metal Industry*, died at Kidney Pond Camps, Mt. Kathadin, Me., Sept. 18. Mr. Langdon was born Sept. 1, 1868, at Jersey City, N. J. After working 8 years in several locomotive and electrical plants, he went to New York in 1892 where he was connected with a metropolitan newspaper. A few years later he joined the *Aluminum World* where he wrote the metal market reviews. Later he bought the paper. In 1903, with the late Edwin S. Sperry, he founded *Metal Industry*, with which was merged the *Aluminum World*. Mr. Langdon was a member of the American Institute of Mining and Metallurgical Engineers, American Foundrymen's association, British Institute of Metals and numerous other organizations.

Presents Data on Sand and Refractories

Several articles of interest to the castings industry are included in a recent issue of "Sands, Clays and Minerals," published by A. L. Curtis, Chatteris, England, including the following: "Zirconium and Its Uses," by L. Sanderson; "Difficulties in the Manufacture of Firebrick," by C. R. F. Threlfall; "Manganese Steel in Crushing Machines," by W. D. Pickering; "Magnesite and Magnesite Blocks," by C. L. Rigby; and "Furnishing a Work Laboratory," by A. L. Curtis.

A Correction

Manufacture of the bronze propellers for the NORMANDIE, was credited to J. Stone & Co. Ltd., Deptford, London, in the August issue of THE FOUNDRY on page 70. We have been informed that two of the propellers were made by that company and two by the Manganese Bronze & Brass Co. Ltd., St. Davids Wharf, London.

Millions of Years

before this fellow appeared on earth

BUCKEYE SILICA FIRESTONE

was in process of formation

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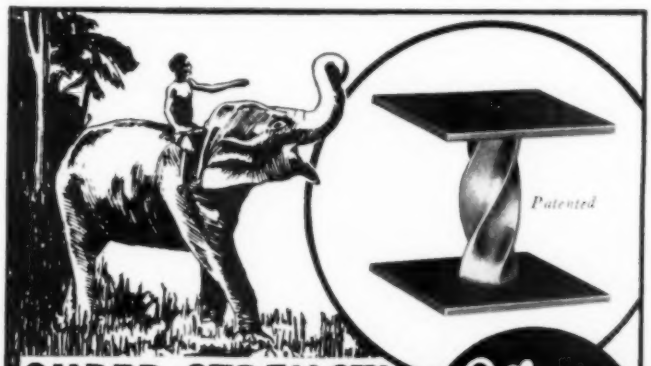

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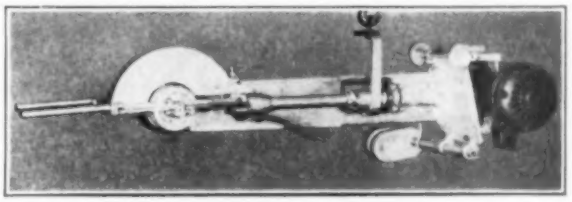


16"——20"——24"

Multiple V-Belt

2 Speed, Fool Proof Safety Drive

Guaranteed for 2 years against any repairs.

Cyril A. Fox

1703 Oliver Building
Pittsburgh, Pa.

NEW EQUIPMENT . . . . for foundries

Lights Specimens For Microscopic Study

Bausch & Lomb Optical Co., Rochester, N. Y., has introduced a surface illuminator for lighting either opaque or translucent specimens when examined at low magnifications. It is said that the illuminator gives a well-balanced annular cone of light which can be varied both in intensity and incident angle. Objects with irregular surfaces reveal a maximum of detail with the aid of the light.

The ring slips over the microscope objective

The illuminator consists of an annular ring holding six bulbs equally spaced around the inside of the ring, with individual reflecting surfaces back of each bulb. The ring slips on over the microscope objective and is held in position by an extension rod suspended from a clamp attached to the eyepiece adapter, which may be either vertical or inclined.

The new illuminator is used either with a standard laboratory microscope, with a body tube diameter of 35 or 39 millimeters, or with a toolmaker's microscope.

Refractory Concrete

Quigley Co. Inc., 46 West Forty-fifth street, New York, has introduced an hydraulic insulating refractory concrete known as Insulcrete, which is used for poured refractory furnace linings such as doors, floors, covers, car tops, special shapes, backing-up, etc. It is claimed that the refractory has a low heat storage, a heat resistance to furnace temperatures up to 2500 degrees Fahr., low permeability, small shrinkage, high load carrying capacity, and high resistance to thermal shock.

Sand Machine Has Self-Loading Feature

Royer Foundry & Machine Co., Kingston, Pa., recently has developed a self-loading and self-propelled sand separator and blender. The unit consists of a bucket elevator equipped with spiral screw conveyors for gathering sand, and a sand separator and blender mounted on a crawler type tractor, as shown in the accompanying illustration.

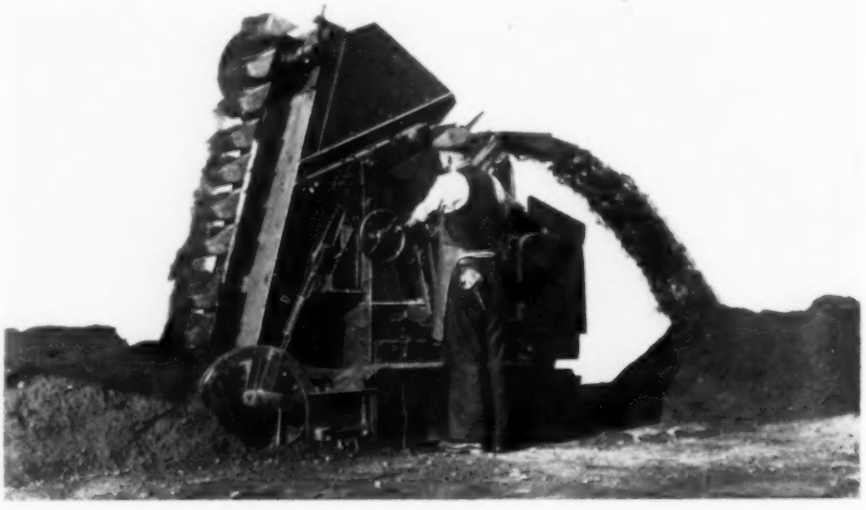
As the unit travels down the foundry floor, the spiral screw conveyors feed the sand into the bucket elevator, which in turn elevates it from the floor and discharges it into the hopper of the sand separator and blender. Here the sand is mixed and then discharged on the floor in a windrow of soft fluffy sand which, it is claimed, has even temper and high permeability.

The unit has five forward speeds and two reverse speeds and is adaptable to varying depths of sand as it lies on the foundry floor after shaking out. All bearings are equipped with forced lubrication and the various clutches and speed reducers are enclosed in a special dust-proof chamber.

The unit is built in two sizes, with capacities of 25 and 40 tons of sand per hour, and may be supplied with electric or gasoline motive power.

Barrel Pump Uses High Pressure

Stewart-Warner Corp., Alemite division, 1826 Diversey parkway, Chicago, has introduced a new high pressure air-operated barrel pump which it is claimed converts any original 100-pound lubricant container into a powergun for industrial and truck lubrication. The pump uses a nitralloy piston and carries a continuous flow of lubricant from the container to a high pressure pump. From there, the lubricant is delivered at the rate of 18 ounces of regular lubricant per minute, or 6½ ounces of the extremely fibrous and heavy lubricants. A pressure, 33 times the air pressure used, is available to supply a delivery sufficient to take care of several grease outlets at one time.

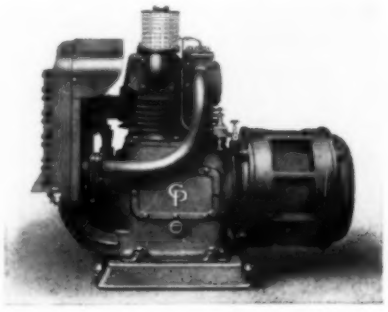


The unit has five forward and two reverse speeds and can handle sand of varying depths

ADVERTISING PAGES REMOVED

Air Compressor May Have Dual Control

Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has introduced a new line of two-stage, air-cooled, motor driven air compressors. Regulation is accomplished by holding open the inlet valves. It is claimed this simple method reduces to a minimum the power required to drive the compressor when unloaded, and affords cooler operation. When the demand for air is intermittent, electric motor driven compressors can be equipped with dual control, that is, a combination of constant speed control and automatic stop and start control.



The motor stator may be mounted on the crankcase

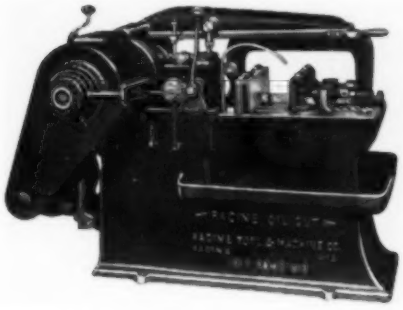
As shown in the accompanying illustration, the motor stator is mounted on the compressor crankcase and the rotor is keyed to the compressor crankshaft. A pilot bearing in the outer motor bracket insures alignment. For the coupled motor drive, the motor is connected through a flexible coupling to compressor and the entire unit is mounted on a structural steel sub-base. The compressor also is available with V-belt drive.

Forced feed lubrication is used throughout. It is claimed the full-floating piston pins eliminate possibility of piston pin seizure and consequent scoring of cylinders.

Cutting Machine Uses Hydraulic Feed

Racine Tool & Machine Co., Racine, Wis., has introduced a new 6 x 6-inch metal cutting machine employing hydraulic feed control. The hydraulic unit comprises a simple piston pump, single control lever and two graduated dials for feeds and pressures. The entire unit is a subassembly easily removable if desired.

A built-in three speed transmission with hardened steel gears is enclosed completely and runs in oil. Saw frame has broad bearing areas, so widely spaced that pressure of the blade tends to center the frame above the work. Actual capacity of the machine is 6 x 6-inch square or 6 5/8 inch round with vise straight and 4 1/2 x 6 5/8-inch with vise set at 45 degrees for angle cutting.

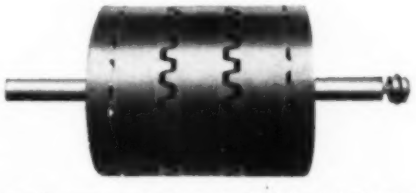


The hydraulic unit is a subassembly and can be removed easily

Slotted table allows chips and compound to fall through into a chip pan away from moving parts. The machines are made for belt drive or motor drive.

Heat Dissipation Features Magnetic Pulley

Dings Magnetic Separator Co., has developed a new magnetic pulley with transverse and longitudinal radiating ducts for the proper dissipation of heat. Coils are wound upon individual bobbins, which form the core and the two poles. Separate bobbins are mounted upon the pulley shaft, each bobbin being securely keyseated to the shaft. The outer and inner faces of the bobbin are corrugated, to provide a maximum radiating surface.

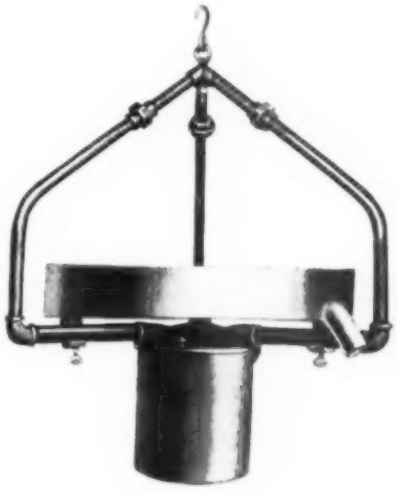


Coils are wound on individual bobbins which form the core and two poles

The coil covers are of heavy bronze. It is pointed out that there is no short circuiting of lines of force between the two poles, as is the case when steel spacer rings are used. The magnetic pulley shaft is turned and polished. Each pulley is supplied with set collars, bronze collector rings with double contact brushes for each collector ring, dust proof collector ring housing and steel switch cabinet in which is mounted a pilot lamp with bullseye indicator to show when the current is flowing, fuse, switch and special kick absorbing resistance.

Vibrating Riddle Has Removable Screen

Vibro Mfg. Co., 166 West Jackson Boulevard, Chicago, has introduced several changes in design in its sand riddle. The main addition to the tubular steel frame carrying the built-in, eccentrically weighted motor, is a strong steel bowl, 4-inches high and 20-inches in diameter, with a 1-inch steel ring welded around the center. The wire screen, held between two steel rings and provided with two handles for instant installation and removal, rests on the ring. A 3-inch side outlet pipe is provided to carry the clean sand into containers for distribution among molders, instead of discharging on the floor.



A side outlet pipe will carry clean sand into containers for distribution

Two slots on the bowl, 1-inch above the wire screen, allow the discharge of tailing automatically. A spout, on the principle of one used on a water sprinkler, is supplied and may be attached to the outlet on the steel bowl where the even spraying of sand over the mold is desired.

Separate sets of steel rings with different screens of any desired mesh can be used where desired. The new bowl can be removed and any riddle from 12 to 24-inches in diameter substituted.

Tells Story of Nickel

A complete story of the production and use of nickel is shown in a new two-reel silent educational motion picture film recently prepared under the supervision of the United States bureau of mines, department of the interior. The film will be loaned for exhibition purposes.

The "CHAMPION" Riddles Sand All Over The World

WHY?

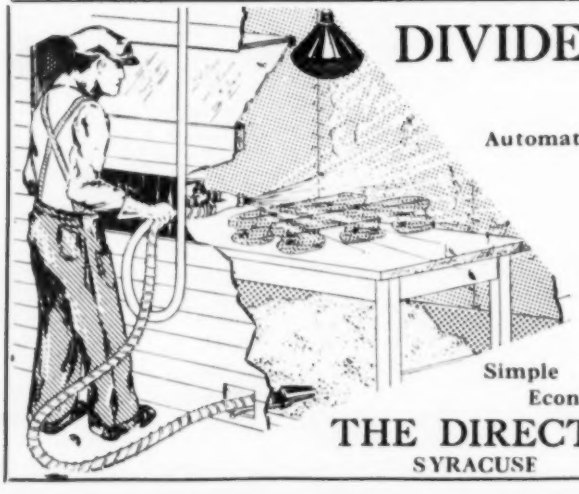
Why a *Champion?* You should choose a *Champion* riddle because it excels in every department of the game.

- **It riddles as much sand in 5 MINUTES as a man can riddle by hand in an hour.**
- **It costs less than 2 (two) cents an hour to operate.**
- **It is standard equipment in the most progressive foundries in the world.**

Installing a Champion riddle in your foundry means that you *immediately* save $9.00 out of every $10.00 that you now pay molders and helpers for riddling sand.

Let us ship you a "Champion" on trial. If after 30 days you do not think it is the greatest time and money saver made, ship it back to us.

Champion Fdry. & Machine Co.
3016 West 21st Place Chicago, Ill.



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* * * *

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Simple — Efficient — Inexpensive

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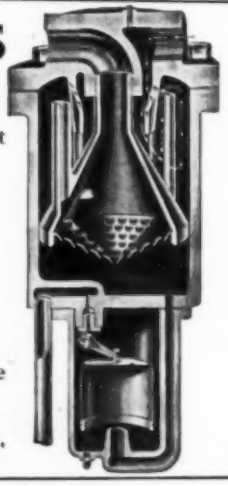

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Fire Clay and Fire Clay Flour

Fire Clay Brick

Therm-O-Flake Insulation

Illinois Clay Products Company

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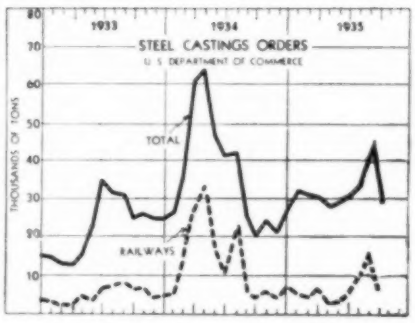

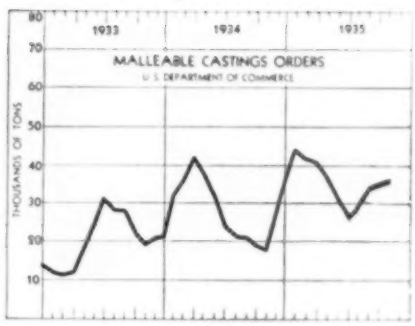

Foundry Activities

Reflect Industrial Trends

FOUNDRY operations in the Chicago district expanded during October, the gain, as measured by pig iron shipments, being around 20 per cent. Expanding schedules of automotive parts suppliers aided the upturn, though betterment was fairly general elsewhere. Tractor manufacturers continue schedules near capacity, but production of some seasonal tools has been slightly less active. Business in railroad castings continues slow, and operations of steel foundries generally are on a lower basis than gray iron and malleable plants. Larger foundries contracted heavily for pig iron to avoid the $1 increase in prices which became effective last month. Fourth quarter pig iron shipments are expected to be the heaviest in more than five years.

* * *

Neenah Foundry Co., Neenah, Wis., is building an addition to its shop and adding a new sand house.

* * *

Tennessee Copper Co.'s foundry, Copperhill, Tenn., recently was damaged by fire.

* * *

Favorite Foundry Co. Inc., New York, has been incorporated to deal in iron and cast iron parts.

* * *

Lake Shore Engine Works, Marquette, Mich., plans rebuilding its pattern shed, recently damaged by fire.

* * *

Ebco Mfg. Co., 401 West Town street, Columbus, O., recently organized to take over the D. A. Ebinger Sanitary Mfg. Co.'s plant, plans to erect a gray iron jobbing foundry, according to A. R. Benua, general manager. Adam E. Fisher will have charge of rebuilding the Ebco foundry and equipping it with modern equipment for the production of gray iron castings.

* * *

Eaton-Erb Foundry Co., Vassar, Mich., has installed three additional permanent mold units each producing about 10 tons of castings per day.

* * *

Stenzel Pattern Works, 2300 Nance street, Houston, Tex., is planning erection of a factory, 60 x 75 feet, at Navigation and Hutchinson streets. Air conditioning equipment will be installed.

* * *

Pacific Foundry Co., Box 1254, Tacoma, Wash., has been incorporated with capital of $15,000.

* * *

A. E. Martin, veteran Milwaukee foundryman and owner, A. E. Martin Foundry & Machine Co., Milwaukee, reports that his business is running about 40 per cent ahead of last year.

* * *

Atlas Foundry Co., 700 North Summitt avenue, Charlotte, N. C. is planning the inauguration of increased production, it was announced by L. J. Nolen, proprietor.

* * *

General Castings Co. Inc., New York, has been incorporated to manufacture steel, iron and bronze castings by Flora B. Tompkins, Samuel S. Tompkins, Charles S. Moan.

* * *

Elyria Foundry Co., Cleveland, has been incorporated with $2500 capital by Charles Follett, Terminal Tower building, Walter H. Nye and James R. Stewart.

* * *

Production of the Peerless Foundry Co., Indianapolis, is reported running at the highest rate in several months, according to T. J. Cornwell, president.

* * *

Sterling Wheelbarrow Co., West Allis, Wis., is completing plant modernization work costing approximate-

RAW MATERIAL PRICES
Nov. 6, 1935

Iron	
No. 2 foundry, Valley	$19.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	19.50
No. 2 foundry, Buffalo	19.50
Basic, Buffalo	18.50
Basic, Valley	19.00
Malleable, Chicago	19.50
Malleable, Buffalo	20.00
Charcoal iron, furnace	22.00
Coke	
Connellsville beehive premium	$5.50 to $5.75
Wise county beehive coke	4.50 to 5.00
Detroit by-product coke	9.00
Scrap	
Heavy melting steel, Valley	$13.50 to $14.00
Heavy melting steel, Pitts.(dlv)	13.00 to 13.50
Heavy melting steel, Chicago	12.25 to 12.75
Stove plate, Buffalo	10.25 to 10.75
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	7.75 to 8.00
No. 1 cast, mchy., Chicago	11.50 to 12.00
No. 1 cast, Pittsburgh	13.00 to 13.50
No. 1 cast, Philadelphia	12.50 to 13.00
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	13.00 to 13.50
Car wheels, iron, Chicago	12.50 to 13.00
Railroad malleable, Chicago	14.50 to 15.00
Malleable, Buffalo	14.50 to 15.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	8.85 to 8.95
Straits tin	52.50
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	17.00 to 17.50
Lead, New York	4.50
Antimony, New York	15.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.85

ly $30,000, principally for the purpose of introducing a new line of foundry equipment. The company is increasing its line of steel foundry flasks to include units of larger capacity.

* * *

Pratt & Letchworth Co. Inc., Buffalo, has discontinued malleable foundry operations. No change will be made in the manufacture of steel castings and specialties.

* * *

Montana Iron Works, 920 South Arizona street, Butte, Mont., has been granted a building permit for alterations and remodeling of its plant for the fabrication of structural steel.

* * *

Fire of undetermined origin recently did approximately $20,000 damage to a warehouse building forming part of the plant of the Sydney Foundry & Machine Co., Sydney, Nova Scotia.

* * *

Full control of the Batavia Pattern Works, Island avenue and First street, Batavia, Ill., has been purchased by John Ahlgren from his co-partner Severo Pasetti, thus dissolving the partnership.

* * *

Standard Brake Shoe & Foundry Co., Main and Bodley streets, Memphis, Tenn., soon will start work on the erection of a $250,000 steel and iron foundry. An electric furnace will be installed in the new plant.

* * *

Willoughby Brass Foundry, Willoughby, O. recently was established with J. K. Luton as president and general manager of the concern. The company specializes in brass, bronze and aluminum castings and also makes patterns for castings.

* * *

Centralia Foundry & Machine Co., Inc., Centralia, Wash., has been incorporated to carry on a general foundry and machine shop business by J. C. Hampe, C. A. Althauser, William H. Grimm, J. D. D. Wonderly and W. H. Copping with capital of $10,000.

* * *

Schultz Die Casting Co., Toledo, O., has started construction of a new unit, 60 x 140 feet. The enlargement, it was reported, was necessitated by an increased demand for die castings. Cost of this enterprise is estimated at $15,000.

* * *

Lebanon Steel Foundry, Lebanon, Pa., has appointed Peter A. Frasse & Co. Inc., with offices in New York, Philadelphia, Buffalo, Hartford, Rochester, and Syracuse, as representatives for its corrosion, stainless and heat resistant alloy cast products.

* * *

Mesta Machine Co., West Homestead, Pa., was awarded the prize for the most attractive exhibit at the Purchasing Agents' of Pittsburgh industrial exhibition held at the William Penn hotel, Pittsburgh, Oct. 10 and 11.

* * *

American Foundry & Machine Co., 870 South Fourth street West, Salt Lake City, Utah, plans construction of a new pattern shop and warehouse. Improvements are being made in anticipation of increased business, according to P. A. Mattingly, general manager.

* * *

Cadillac Brass & Aluminum Co., Cadillac, Mich. and newest local foundry, has poured its first lot of castings. The new industry is established in the former machine shop of the Cummer-Diggins chemical plant. Equipment includes two aluminum furnaces and one brass furnace. Capacity of the furnaces is said to be 1500 pounds of brass and a total of 1500 pounds of aluminum. R. J. Dykema of Hart, Mich., is owner and manager.

* * *

Output of gray iron and steel castings in the Philadelphia federal reserve district for September declined to the lowest point since last April, according to reports received by the Industrial Research department, University of Pennsylvania. Malleable iron production declined less than 1 per cent from the peak reached in August.

* * *

Index of foundry equipment orders for September, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 128.4 as compared with 113.0 for August and 46.4 for September 1934. Index of shipments was 124.7 as compared with 97.2 in August and 37.0 in September of last year.

NEW *Trade Publications*

INSULATION—A compact little booklet of 64 pages recently published describes and illustrates the insulating products of Johns-Manville, 22 East Fortieth street, New York. A table of recommendations covers insulating materials for various industrial equipment. Sound control in air conditioning systems, mechanical refrigerators, oil burners, metal furniture and other equipment are treated in the illustrated "Sound Control of Mechanical Equipment" brochure.

FLASKS—Hines Mfg. Co., 10108 Detroit avenue, Cleveland, has published a folder on its line of tapered aluminum slip flasks and jackets.

KILN ENDS—Chicago Steel Foundry Co., Kedzie avenue at Thirty-seventh street, Chicago, has published a folder on its pyrasteel kiln ends for use in the cement mill.

GEARS — Medart Co., 3500 DeKalb street, St. Louis, has published a catalog on its line of gears and sprockets. Attachments, chain, roller chain wheels, clutches, etc., also are illustrated and described.

LABORATORY SERVICE — Services available in its chemical and metallurgical laboratories are described and illustrated in a folder recently published by the Robert W. Hunt Co., Chicago.

CONVEYORS—Standard Conveyor Co., North St. Paul, Minn., has published a catalog on its line of conveyors for steel mill and foundry service. A variety of interesting photographs illustrate the application of the conveyors in a wide variety of foundries. Both power and gravity conveyors are shown.

PROTECTION — Willson Products Inc., Reading, Pa., has published a 32-page catalog of its protective equipment for the eyes, head, nose and throat with contents page for easy reference.

DUST COLLECTORS—A discussion of the dust problems together with the features of Blaw-Knox dust collectors are presented in a folder sent out by the Blaw-Knox Co., Pittsburgh. The frame is all-metal structure.

MIXERS—Patterson Foundry & Machine Co., East Liverpool, O., has published an illustrated catalog on its equipment for mixing various types of liquids. Several styles of stirrers are illustrated.

PYROMETERS—Brown Instrument Co., Wayne and Roberts avenues, Philadelphia, recently has issued a folder on its potentiometer pyrometer for recording, indicating and controlling temperature.

LIFT TRUCKS—Elwell-Parker Electric Co., 4120 St. Clair avenue, Cleveland, has issued a new booklet "This New Industrial Pick-Up," which contains more than 50 photographs of operating installations in various branches

(*Concluded on page* 94)

WHAT IS IRON REGENERATOR?

Iron Regenerator, one of the famous "Foseco" products, is a chemical compound in powder form for purification of Iron and Steel castings. Combining simplicity in application, excellence in its effects, economy in its use and immediate reaction, Iron Regenerator gives you seven major advantages:

1. Removing of slag inclusions. 2. Removing of gases. 4. Closer Grain. 5. Easier machining properties. 6. No attack of linings. 7. No fumes.

Iron Regenerator was first created to answer the demands of foundrymen who needed a solution for the everyday problems of iron melting. It will aid you, too. Send today for a *free sample*, sufficient for ample tests.

FOUNDRY SERVICES, Inc.
107 E. 41 St. N.Y.C.

GATES AND RISERS FOR CASTINGS

By Pat Dwyer

THE material which appeared in THE FOUNDRY, serially over a period of four years has been compiled in permanent form for practical shop service.

It is a complete encyclopedia, a ready reference and a practical guide to sound foundry practice. In addition to a description of every conceivable type of gate and riser, the text covers the application and function of gates and risers to all sizes and types of castings. Illustrations on almost every page enable the reader to grasp the salient points with a minimum of study.

363 pages
244 illustrations

Indexed for ready reference

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is absolutely reliable, and all annoyance to the worker is eliminated.

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Our seasoned Foundrymen are available to assist you with your Core bond problems. Write to

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17 BATTERY PLACE, NEW YORK, N. Y.

KORDEK
DRY SAND BOND

(*Concluded from page* 92)

of industry. Considerable space is devoted to the subject of high tiering and cutting material handling costs.

BEARING UNITS—Link-Belt Co., 910 South Michigan avenue, Chicago, has published a booklet No. 1494 on its self-aligning roller bearing units. The publication describes the construction of the bearings and gives data on capacities.

VIBRATORS—Dallett Co., 165 West Clearfield street, Philadelphia, has published three bulletins, one devoted to the details of design and construction of its vibrator, the second to various types of production and maintenance tools and a third to detachable cable connectors.

COMPRESSORS—An illustrated 32-page catalog of the Ingersoll-Rand Co., 11 Broadway, New York, describes "Type 30" industrial compressors and vacuum pumps, ¼ to 15 horsepower, pressures up to 1000 pounds. Tables of sizes and capacities are included.

SAFETY SHOES—A booklet portraying shoes for safety requirements of every type of industry has been published by the International Shoe Co., 1509 Washington avenue, St. Louis. It carries the slogan "Let's Use Our Heads and Save Our Feet."

BLAST BARREL—Pangborn Corp., Hagerstown, Md., recently has issued an interesting folder describing and illustrating a new airless rotoblast cleaning barrel recently placed on the market.

DUST FILTERS—Dracco Corp., Harvard avenue and 116th street, Cleveland, has published its bulletin No. 301 describing its multi-bag filter for dust control. Illustrations show general and detailed construction features as well as the operating principle of the shaking mechanism.

MEEHANITE—Two bulletins have been published by the Meehanite Metal Corp., Pittsburgh. One is a comparative study of wear resistance properties and the other a comparative study of graphite formation and combined carbon and graphite formation. Photographs, description, graphs and tables are used.

FIRESTONE—Cleveland Quarries Co., Builders Exchange building, Cleveland, announce available bulletins on the use of Buckeye silica firestone in soaking pits, bessemer converters, blast furnace ladles, mixers, drop forge bottoms, gray iron cupolas, and acid tanks.

WELDING—J. H. Critchett, vice president of the Union Carbide & Carbon Research Laboratories Inc., discusses the physical metallurgical and chemical principles involved in the oxy-acetylene welding of steel in "The Metallurgy of Oxy-Acetylene Welding of Steel." An accurate metallurgical study of a welded system is difficult because of the graduations of temperature from normal up to that of liquid metal adjacent to the welded joint.

CUT OFF MACHINES—Tabor Mfg. Co., 6225 Tacony street, Philadelphia, recently has published a folder describing and illustrating its abrasive type cut off machine. Features of the machine are discussed and a table shows the time required to cut hard nonferrous metals with the machine.

TOOLS—Independent Pneumatic Tool Co., 600 West boulevard, Chicago, has issued a catalog of the pneumatic tools manufactured under the Thor trademark. Illustrations cover each type of tool: rotary, piston, pneumatic hammer and accessories together with universal electric, high frequency electric, contractor and mining tools.

COMPRESSORS—A discussion of the application of turbo-compressors to foundry cupolas, oil and gas fired furnaces and ovens, is contained in a recent catalog of the Spencer Turbine Co., Hartford, Conn. Data on construction of the compressor are presented and the advantages of that type unit are discussed.

HANDLING—A 64-page illustrated section of the general catalog of the Palmer-Bee Co., Detroit, gives thorough coverage to screw or spiral conveyor machinery. Diagrams, capacity charts, illustrations, prices, specifications, and an alphabetical index are ready aids to the user.

BLOWERS—A bulletin on the victor-acme rotary positive blowers issued by Roots-Connersville Blower Corp., Connersville, Ind., diagrams power economies effected by the use of blowers; describes operating characteristics, construction and accessory equipment; and gives net capacities at listed speeds and pressures in a selection table.

LABORATORY FURNACES—Ajax Electrothermic Corp., Ajax Park, Trenton, N. J., recently has published bulletin No. 9 on small electric furnaces for laboratory use. Information includes a description of the 3 K. W. converter and furnaces for use with that type of converter.

AIR HEATERS—Electric Air Heater Co. division, American Foundry Equipment Co., Mishawaka, Ind., has published a well-illustrated booklet on its electric type air heaters. The line includes industrial, portable and built-in types. Information also is given on the cast-in electric heating unit which is made in both circular and rectangular styles. Illustrations show installations.

BELT CONVEYORS—Jeffrey Mfg. Co., Columbus, O., has published its catalog No. 610 describing and illustrating a complete line of standardized conveyors and accessories. Sand handling equipment for foundry use is included. Information is presented on the details of construction of the various parts of the conveyor.

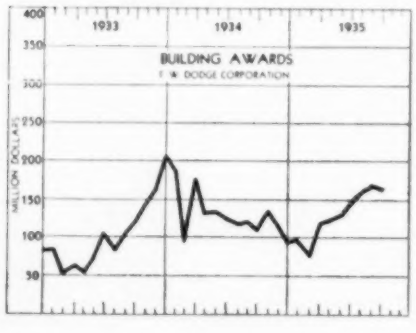
DIESEL ENGINES—Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has published bulletin No. 779 on a new line of diesel engines. Two classifications are given, one for general service use and the other, direct connected for electric service use. Tables giving specifications are included.

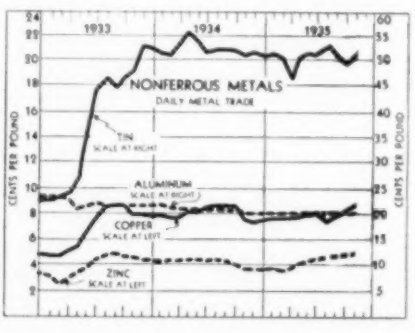
GENERAL ELECTRIC — General Electric Co., Schenectady, N. Y., has published two bulletins. The one describes the development and uses of electric equipment for power shovels. The other gives a description and specification of the various rubber and rubber-like compounds for insulating and sheath applications and how the ingredients affect aging characteristics, dielectric and physical strength.

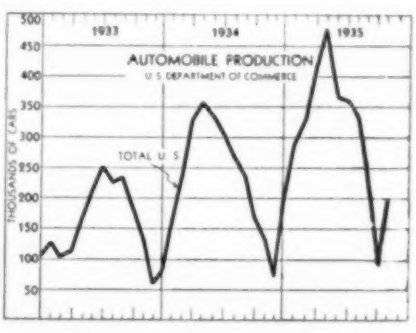
SAND—International Nickel Co. Inc., 67 Wall street, New York, recently has published bulletin No. 403, section 2, dealing with "Molding Sand Characteristics for Nickel Bronzes, Nickel Silvers and Monel Metal." The work was prepared by David M. Curry of the development and research department of that company.

CONVEYORS—Mathews Conveyor Co., Ellwood City, Pa., recently has presented a booklet on its conveying equipment for foundries. Details of construction are presented and illustrations show the application of the conveyor to a wide variety of foundry installations. While the main discussion deals with roller conveyors, power driven conveyors for foundry use also are illustrated.

POWER TRANSMISSION—An indexed catalog of 144 pages, published by the Medart Co., 3500 De Kalb street, St. Louis, is a comprehensive presentation of its line of power transmission equipment. Determination of the size of shafting, weights, properties, and horsepowers transmitted by the shafting are covered by text, diagrams, formulas and tables. List price and dimension tables, photographs, test and often diagrams are used in presenting each of the products.







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At right, radiator-shell die containing Silvery Mayari, made by the Schneider-Bowman Co., Philadelphia.

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